

Rinnai ENERGYSAVER® Direct Vent Wall Furnace Service Fundamentals



The Rinnai Direct Vent Wall Furnace Product Knowledge (201101) and Installation (201102) Presentations are a required prerequisite.

Rinnai ENERGYSAVER® Direct Vent Wall Furnace Service Fundamentals



**The following course is approved for NATE
continuing education hours (CEH's)**

This course will earn the following CEH's:

Warm Air Heating-Gas-Installer – 2 hours

Warm Air Heating-Gas-Service – 3 hours

**If you require credit for NATE, please notify the
instructor at this time**

Rinnai America's phone support structure consists of the following departments:

- **CRC – Consumer Response Center – Fielding general calls, consumer questions, etc.**
 - Available in office from 8 a.m. to 8 p.m. EST, Monday - Friday
- **Parts and Warranty Department – Fielding parts orders and warranty issues**
 - Available in office from 8 a.m. to 5 p.m. EST, Monday – Friday
- **Technical Support Department– Fielding technical issues related to the function of all Rinnai Products**
 - Available in office from 8 a.m. to 8 p.m. EST, Monday – Friday AND **24/7/365** on call support for technicians who are at the service location. A dedicated service line is available for technicians and installers: 1-888-RINNAIS (888.746.6247)
PLEASE DO NOT GIVE THIS NUMBER TO CONSUMERS.
- **Engineering / Applications Department – Fielding issues related to product applications including sizing**
 - Available in office from 8 a.m. to 5 p.m. EST. (The engineering dept does not size heating appliance applications—an industry accepted Btu heat loss calculation must be performed by the installer)

www.rinnai.us – For extensive product, sales, and service information. Of Note—a comprehensive documents library is available at the sales/service link. Website registration is required for access.

Product Model Numbers and Specifications

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| NEW MODELS | PREVIOUS MODELS | CFM* | MAX POWER* | DECIBELS* | INPUT BTU RANGE* | AFUE (Efficiency)* |
|---------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|-------------|------------|-----------|--------------------------------------|--------------------|
| EX08C | ES08, RHFE 201 FA | 55.5-82.0 | 41-42 W | 27-36dB | 3,000-8,000 NG/LP | NG-82% LP 83% |
| EX11C | ES11, RHFE 263 FAII | 69.3-102.5 | 44-47 W | 31-38dB | 5,500-11,000 NG 5,700-11,000 LP | NG-81% LP-82% |
| EX17C | ES17, RHFE 431 FAIII EX17, RHFE 431 WTA | 111.3-137.8 | 40-46 W | 33-38dB | 8,200-16,700 NG/LP | NG-81% LP-82% |
| EX22C | ES22, RHFE 556 FAIII EX22, RHFE 556 WTA | 111.3-162.7 | 52 W | 32-42dB | 8,200-21,500NG 8,200-20,700 LP | NG-81% LP-82% |
| ES38 | RHFE 1004 FA | 203.4-360.6 | 121 W | 37-47dBA | 10,500-38,400 NG 10,500-36,500 LP | NG-80.6% LP-82% |
| Ensure the correct part number is identified for service / parts support *Current model specifications-previous models may slightly vary | | | | | | |



ES38



EX17C
EX22C

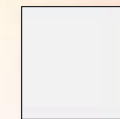


EX08C
EX11C

All models available in beige
EX22(C) and ES38 models are
also available in white.



Beige



White

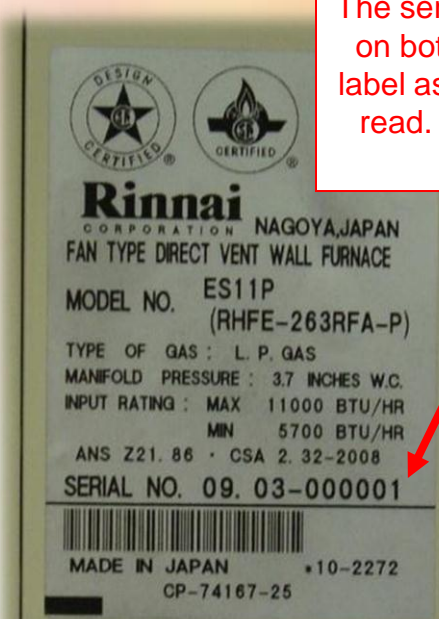
Product Model Numbers and Specifications

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Model Number & Serial Number (located on both sides of the product)



2008 and older:
The model number is located at the top of each side of the product. The serial number on older product is located on the bottom of both sides of the product.



2009 and newer:
The serial number is still located on both sides but in the same label as the model and easier to read. It is also located on the rear of the unit

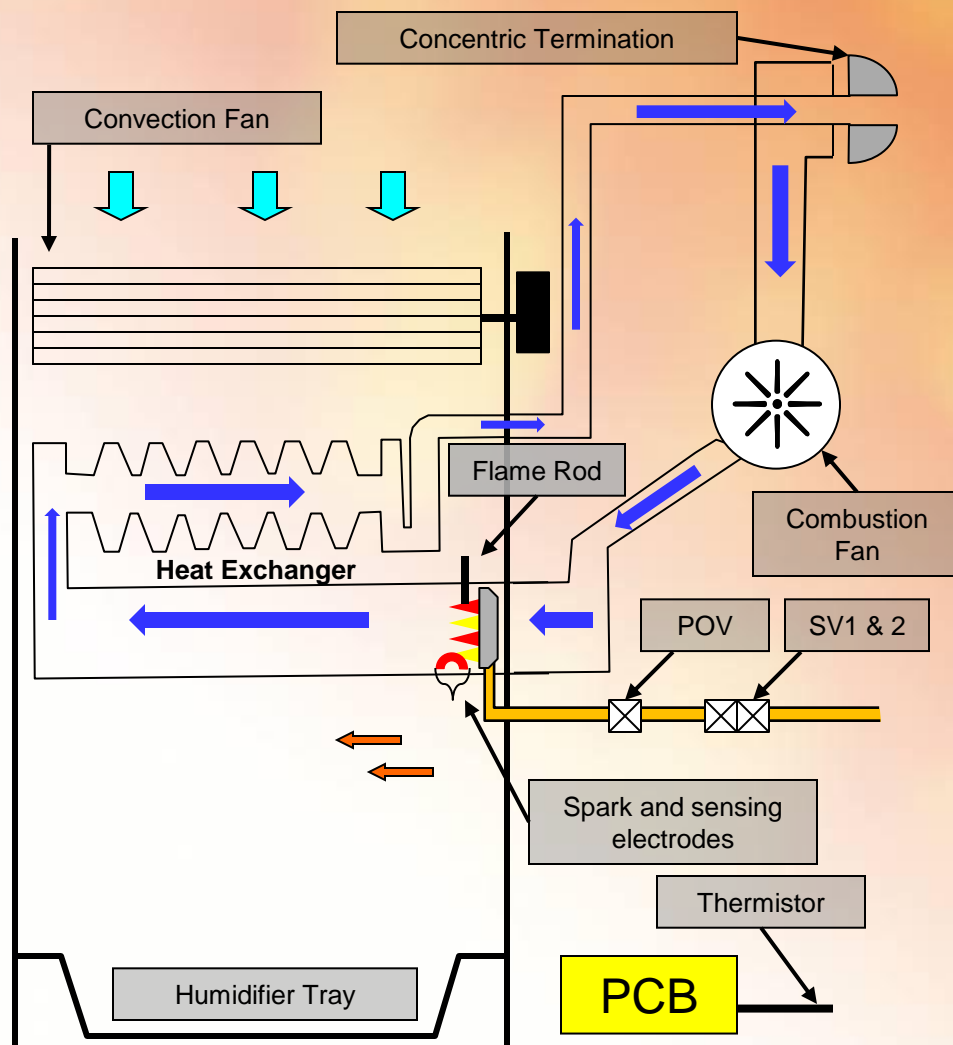
2010 and newer:
The serial number will be in the following format: YM-FT-XXXXX
Y=Year, M=Month, F=Factory of production, T=Type of product, X=production number

ENERGYSAVER® Direct Vent Furnaces

Operation Sequence

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1. Combustion fan purges heat chamber, PCB verifies fan rotation
2. Ignition spark begins
3. When sensing electrode detects spark, gas valve assembly opens
4. Ignition occurs and heat exchanger warms
5. Spark stops as flame rod & PCB verify flame
6. When heat exchanger is warm enough, convection room blower circulates warm air into the structure.
7. When filled, the humidifier tray ensures the air is not too dry (if needed)
8. Thermistor & PCB determine gas and fan settings
9. When temperature set point is reached, if needed, gas valves close & combustion fan stops. Convection fan continues to run to cool down unit.
10. When temperature drops, process starts over



Primary Service Tools

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For service, troubleshooting, and component replacement, the following primary service tools will be needed (other tools could be needed on occasion)



#2 Phillips Head
(magnetic)

Screw Driver



U-Tube or Digital

Dual Port Manometer



3/16" Allen Wrench



Multimeter
(Volt/Ohm Meter)

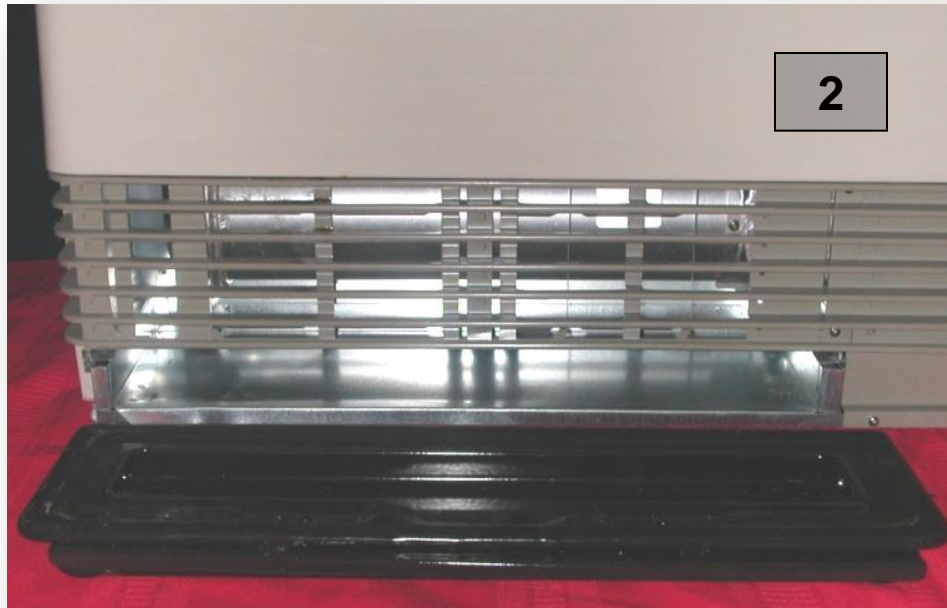
PRODUCT DISASSEMBLY AND COMPONENT REVIEW

The following procedures are for the
RHFE 431 / 556 models manufactured 2008 or earlier
Service procedures for other models will vary
C-Series model disassembly is in Appendix A of this presentation
Please stay with the presentation

Disassembly / Component Review

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1. Remove toe kick from bottom front of unit

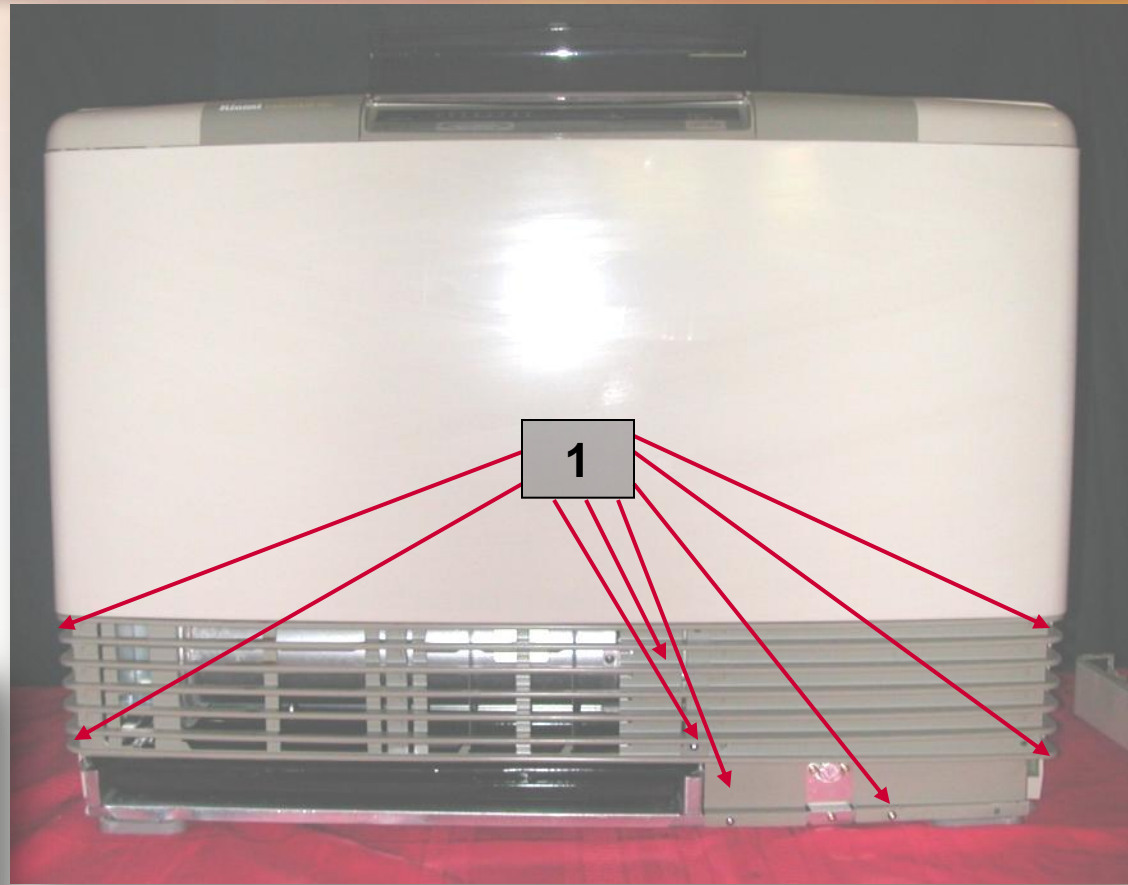
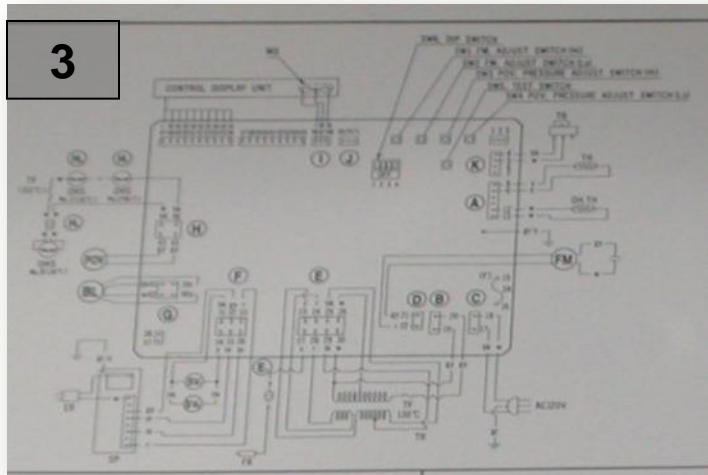


2. Slide the humidifier tray from bottom left of unit—tray will release

Cover Removal

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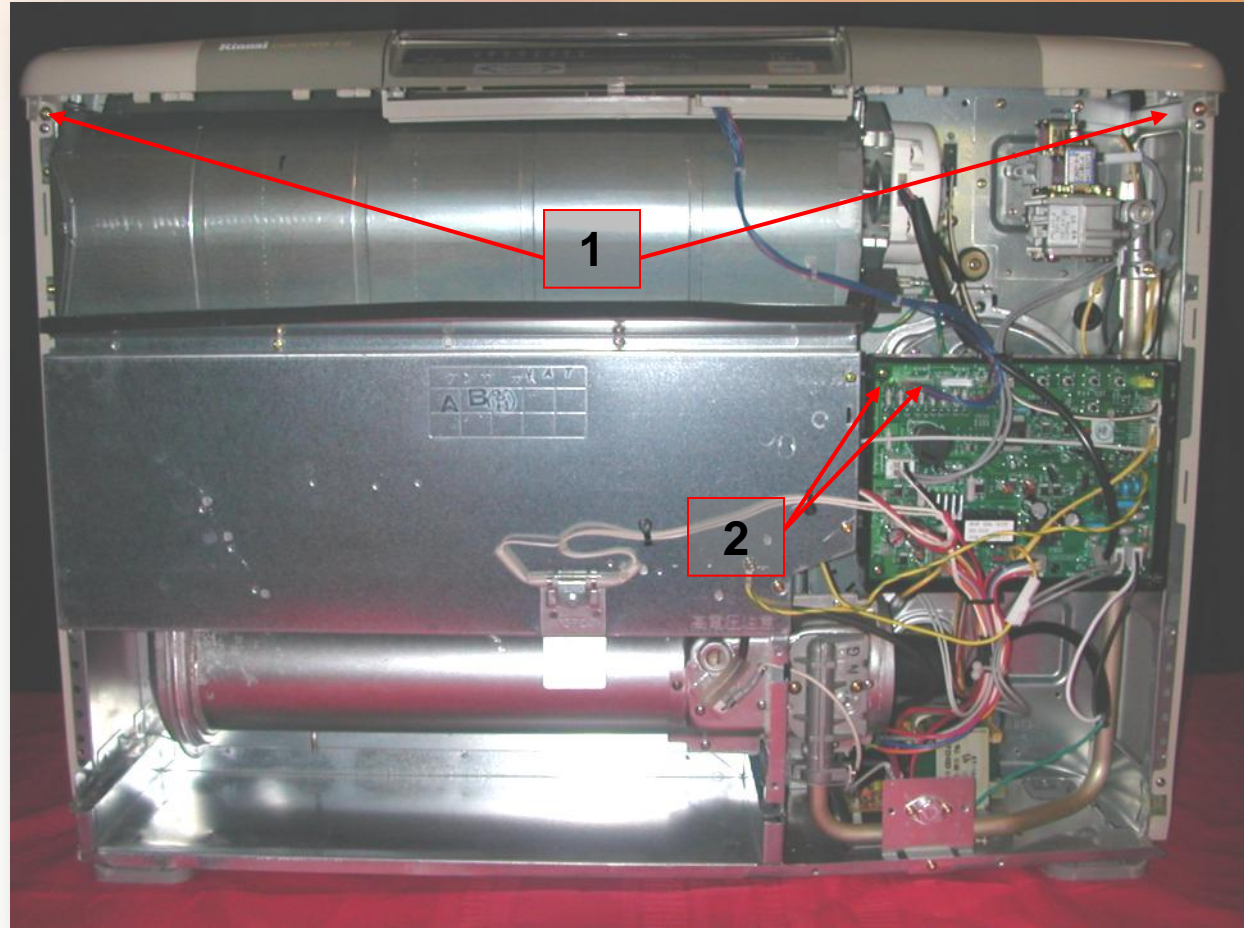
1. Remove 8 screws from the lower front panel
2. Pull out on the bottom of the panel and the top will drop down from slots
3. Inside of cover has valuable information including the wiring diagram



Control Panel Removal

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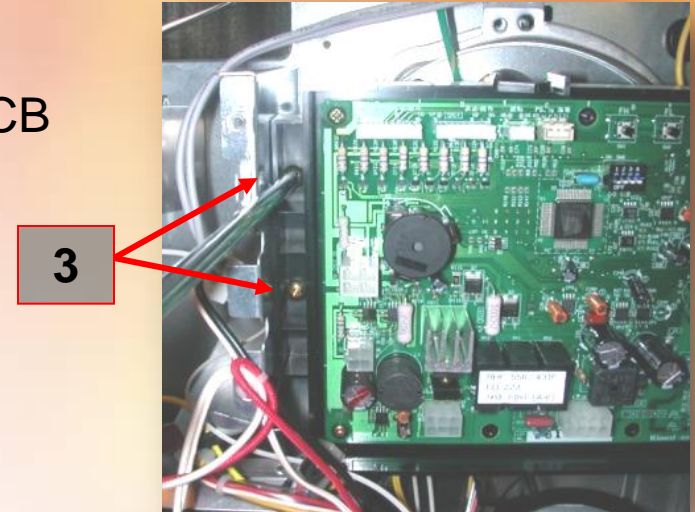
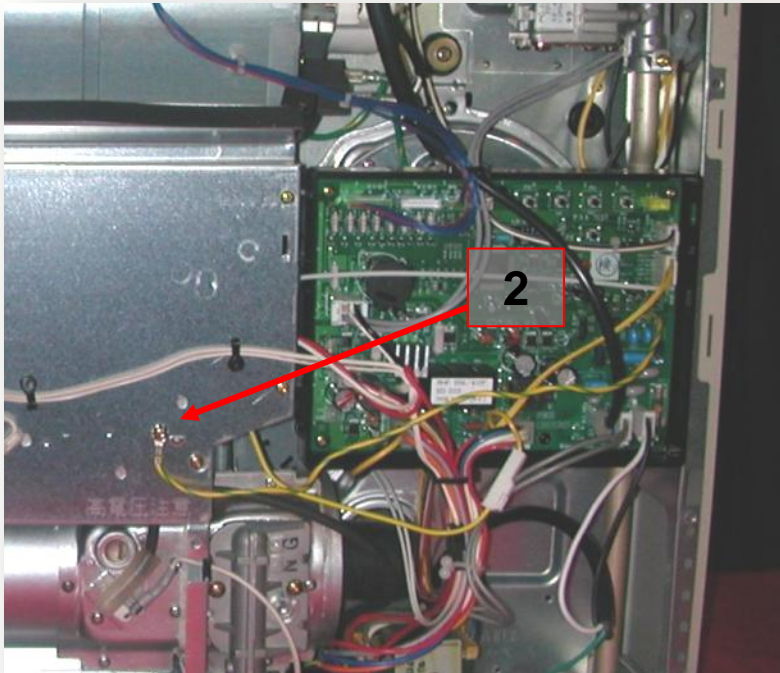
1. Remove the top 2 control panel screws
2. Disconnect control wiring from PCB
3. Pull forward, then up on top panel to remove



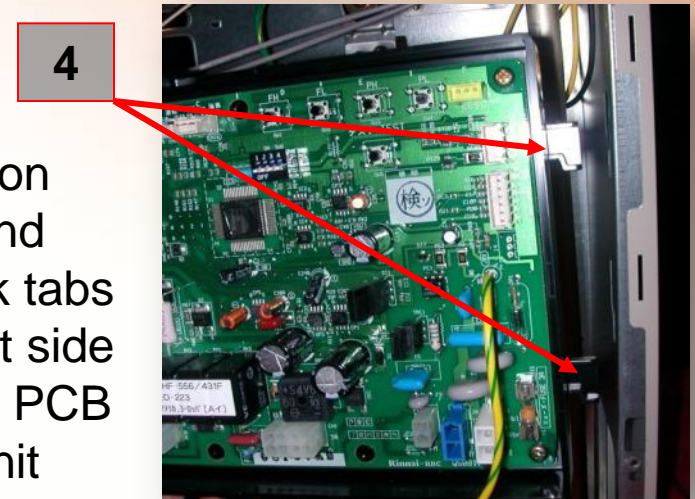
PC Board Removal

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1. Isolate unit from power and gas
2. Remove all wires from PCB. All connectors to PCB have a release point on the Molex. Remove grounding wire from inner panel
3. Remove two screws on left of PCB assembly



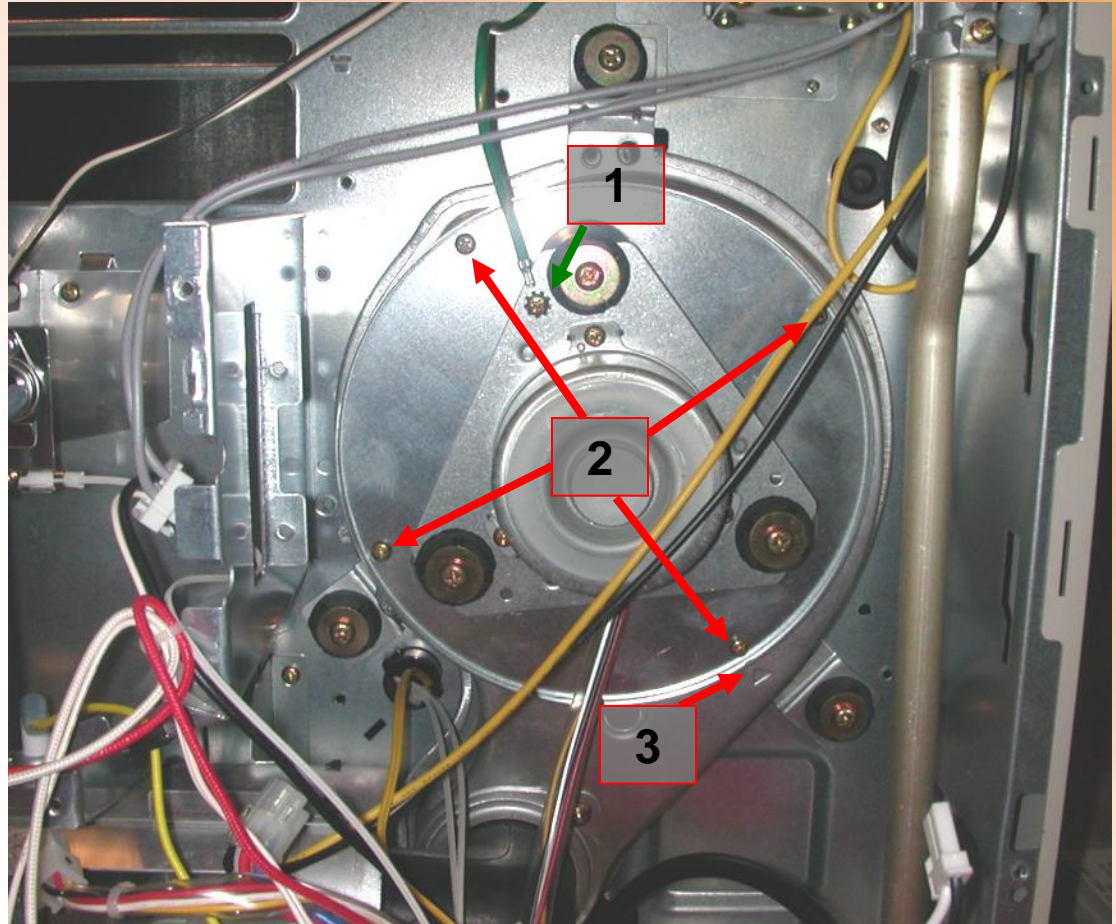
4. Lift up on PCB and unhook tabs on right side freeing PCB from unit



Combustion Fan Removal

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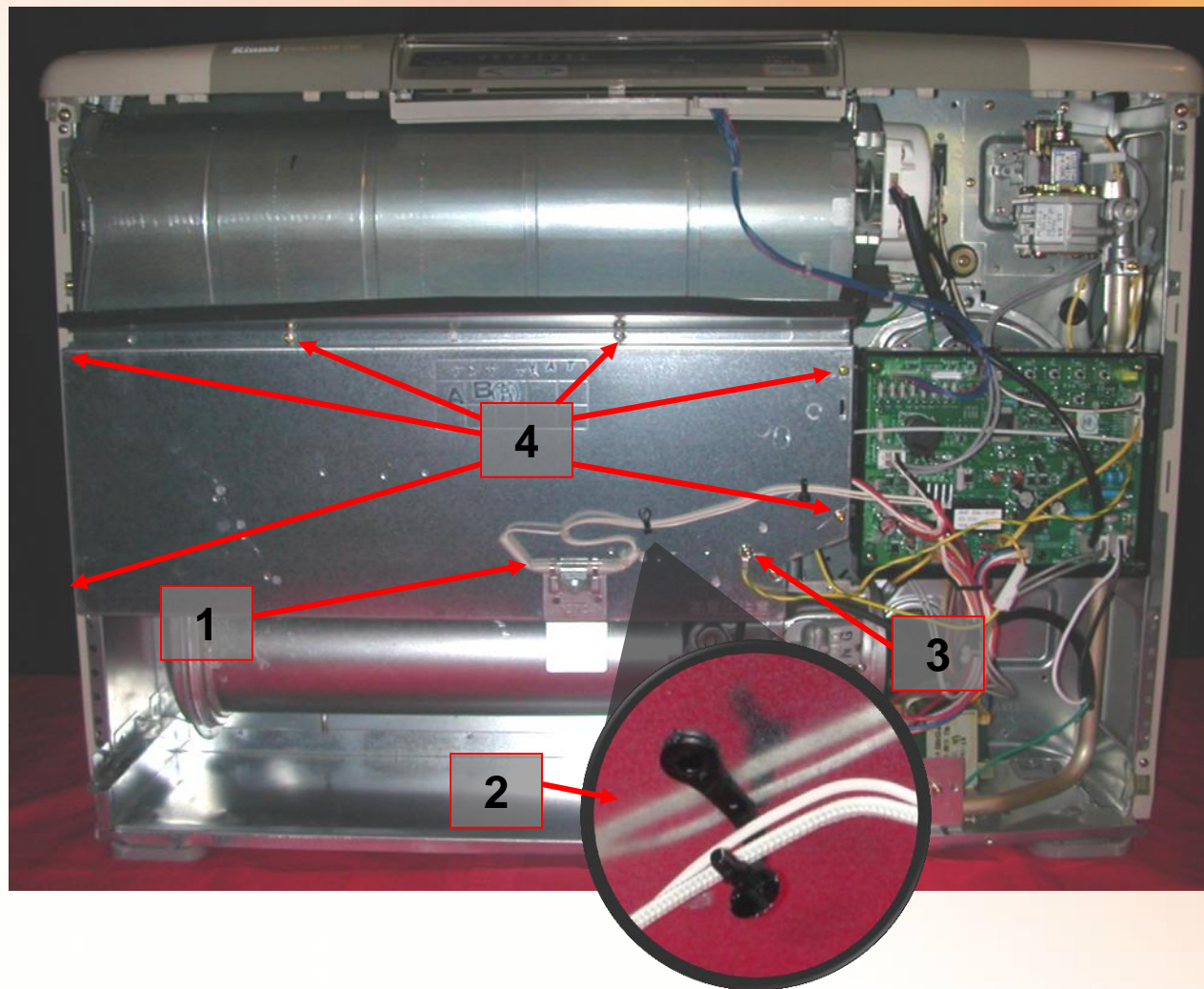
1. Remove the ground screw and wire.
2. Remove the four screws on the inducer motor plate.
3. Note the indicator marks in the 5:00 o'clock position for alignment.



Inside Panel Removal

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1. Remove thermal overheat fuse by pulling up on bracket. Fuse opens at 314° F
2. Open fuse harness clamps to release wires
3. Remove ground wire from panel. NOTE: Unit will not operate with this wire disconnected from unit
4. Remove 6 screws to remove inside panel



Safety Component Review

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Over heat bimetals
one on the front & one on the back
(266° F degrees)

266° F bimetal
behind this plate

Filter light thermistor
(install flat in the 3:00 position)

Flame rod
(Easiest way to clean is
through sparker opening)

Sparker (remove this plate to see/clean flame rod)

Spark Sensing
(This is not a flame rod)

Flame rod disconnect for
measuring current

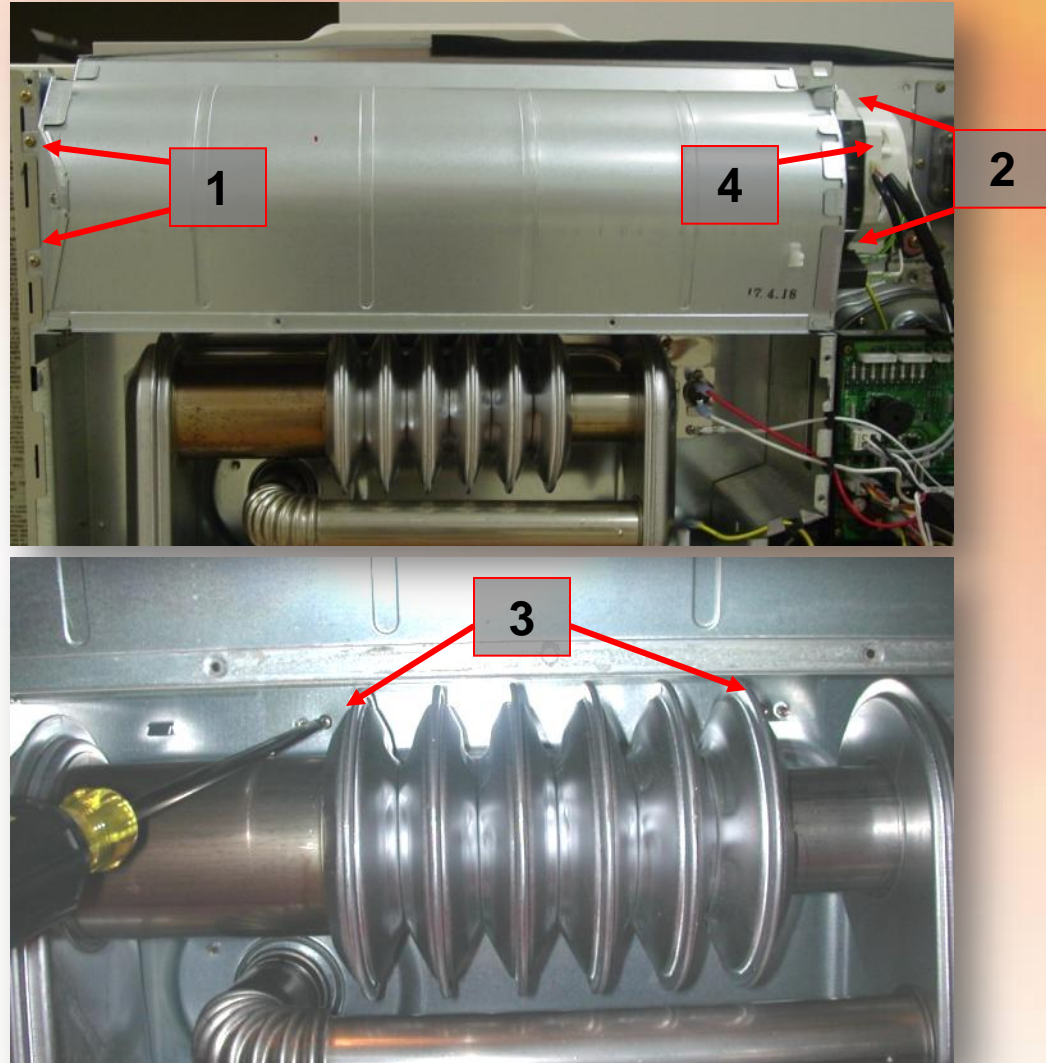
Over heat bimetal
194° F degrees

All bimetals
are in series
with thermal
fuse. Any
open or break
on this circuit
causes an
overheat code

Convection Fan Removal

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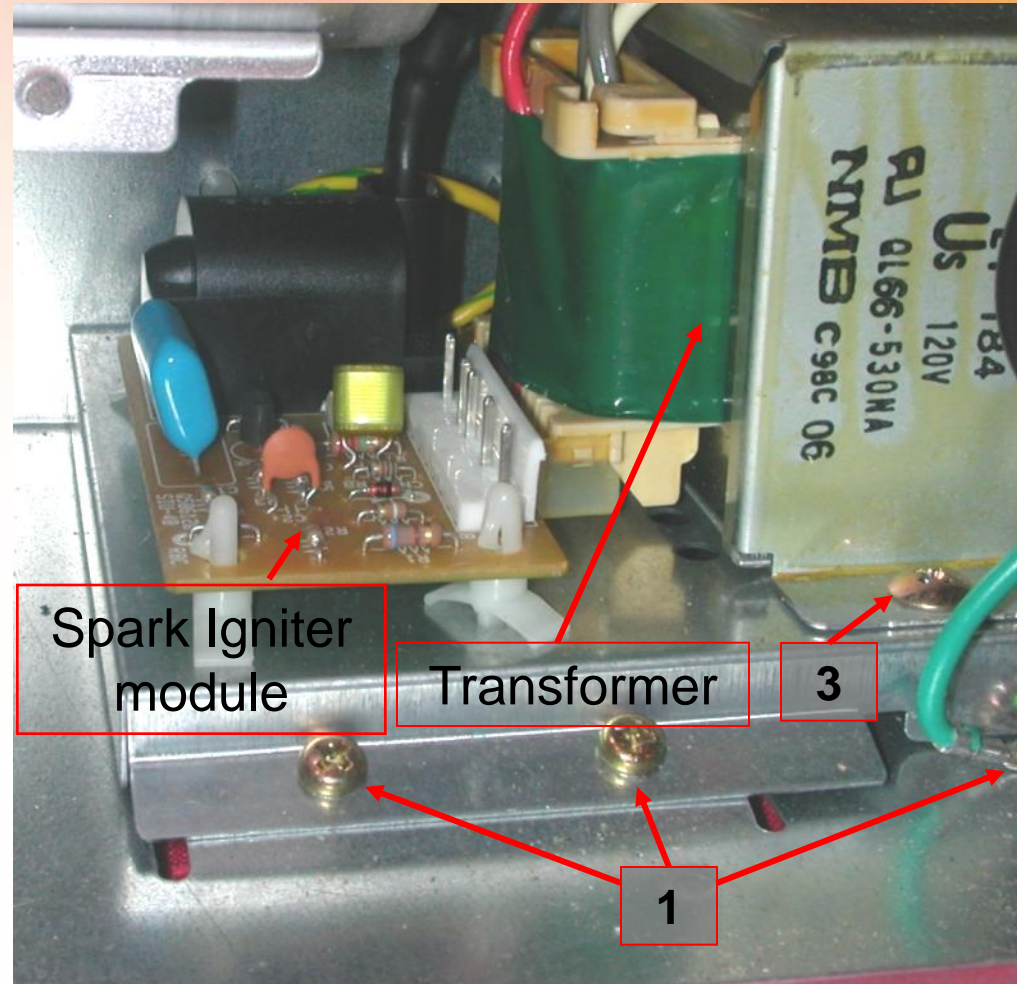
1. Remove 2 screws on left of assembly
2. Remove 2 screws on right of assembly
3. Remove 2 screws below assembly (behind heat exchanger)
4. To remove motor from assembly loosen set screw on motor shaft and remove the 4 screws holding the motor to the housing
5. The tangential wheel design is quieter in comparison to a centrifugal style blower



Spark Module / Transformer Review

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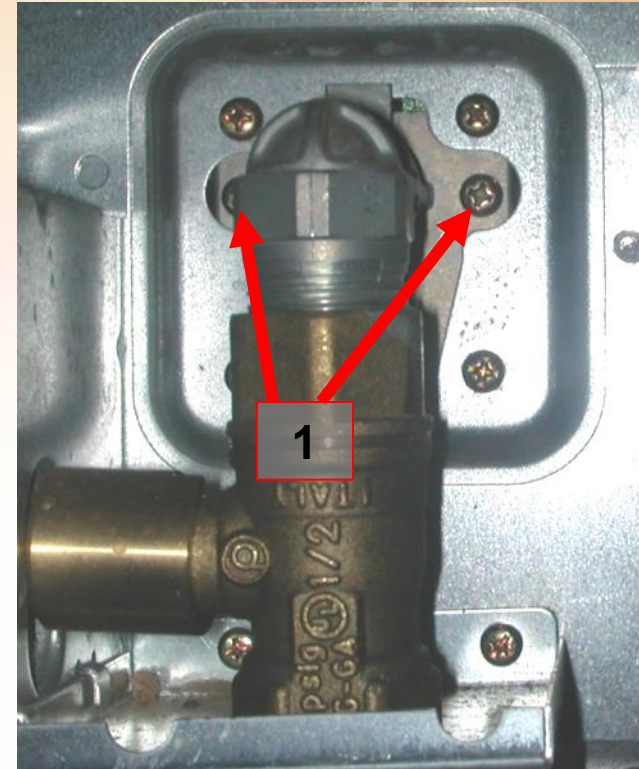
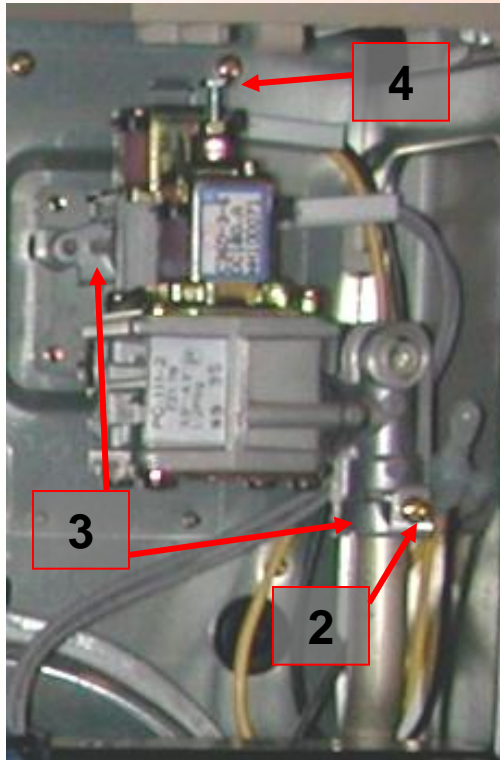
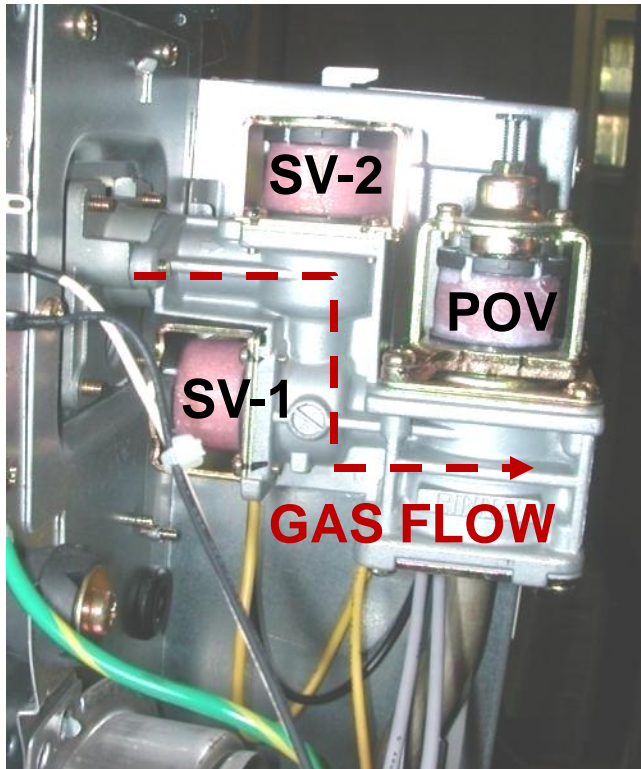
1. Remove two screws and ground wire
2. Bottom tray that houses spark module and transformer will come free
3. To remove transformer only: remove single screw securing transformer to tray. Note tab fitted into slot on rear of transformer
4. Spark module operation:
 1. 85-110VAC is applied to the module from the PCB via the blue and red wires.
 2. Voltage is stepped up at the module and applied in the burner via the black wire.
 3. If the spark occurs correctly, the voltage is returned to the module via the white wire.
 4. Voltage is returned to the PCB via the gray and orange wires thus allowing the gas valve to open.



Gas Valve Assembly Removal

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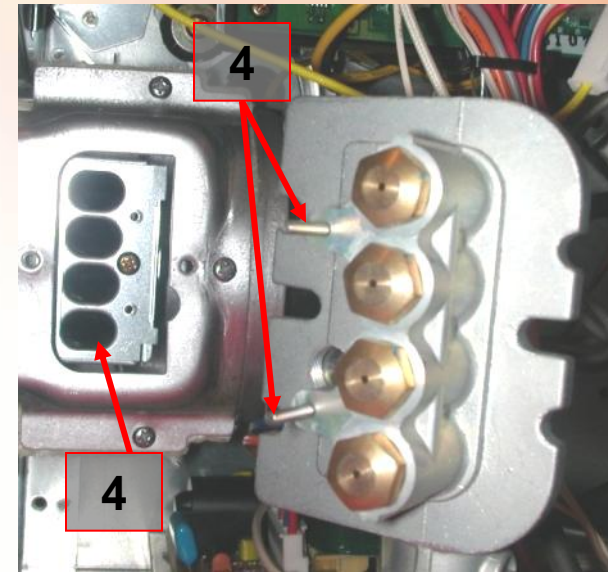
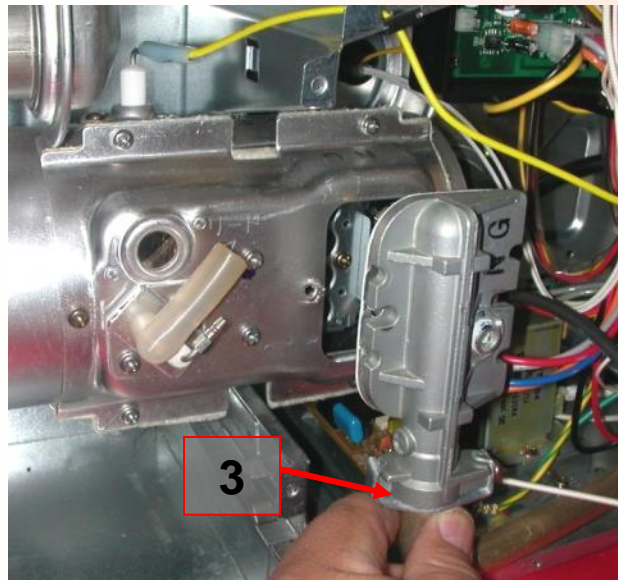
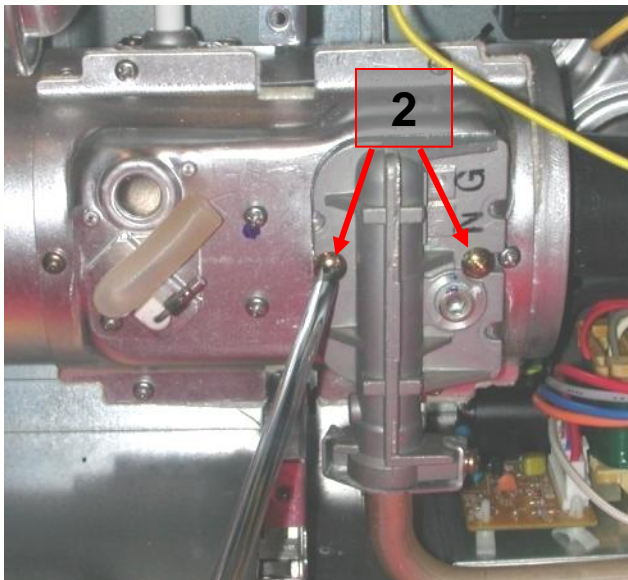
1. To remove, remove two screws on back of unit (ensure correct screws are removed)
2. Remove single screw at gas tubing
3. Note gasket and o-ring where assembly connects
4. NOTE: POV screw should only be adjusted during replacement or under Rinnai direction
5. Ensure gas valve assembly is installed before completing next slide



Gas Manifold Removal

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1. Ensure 194° F bimetal bracket is removed first
2. Remove two screws holding manifold
3. Gently swing manifold out for access to venture openings and orifices. **NOTE:** There is an o-ring where gas tubing connects with manifold.
4. Upon reassembly, ensure alignment pins are seated correctly
5. For nuisance flame related errors, carefully burn-out venture openings with a propane torch and blow out crystallized remnants with high air pressure. This will ensure no spider webs have settled in openings.

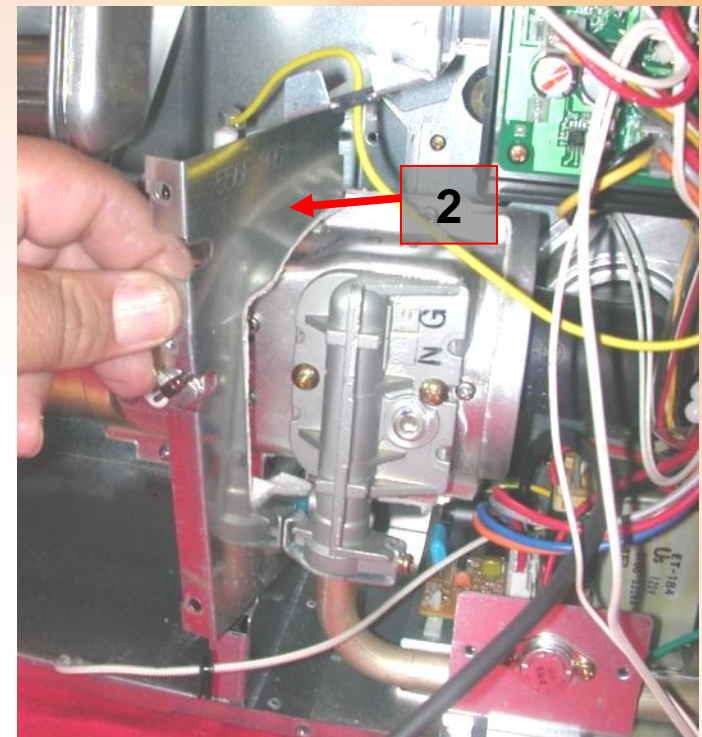
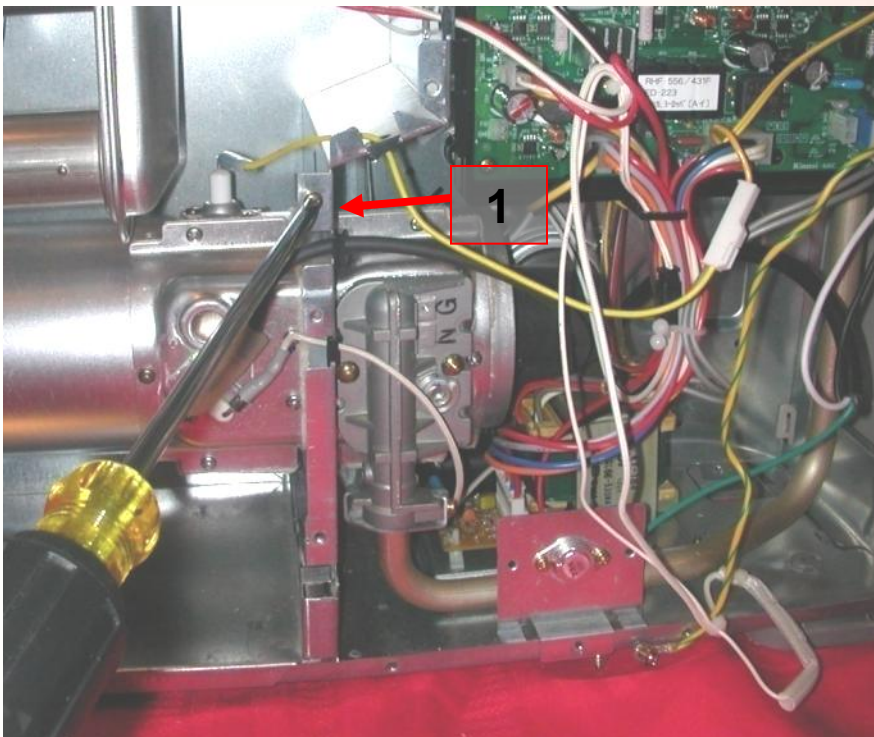
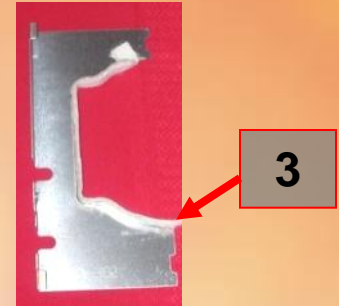


Warm Air Seal Panel Removal

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1. Remove top screw from panel
NOTE: bottom screw was removed with front cover
2. Pull panel free
3. Panel fiber gasket must remain intact

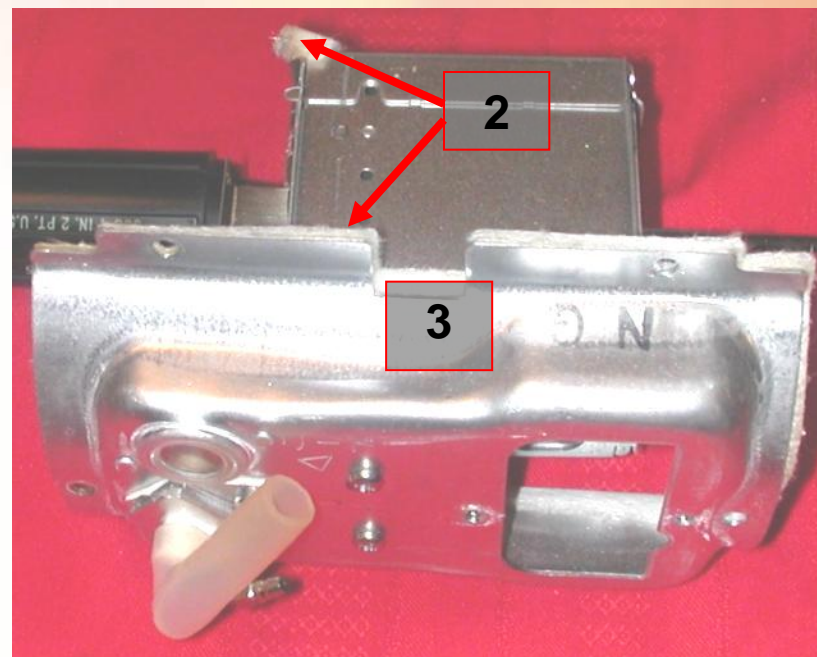
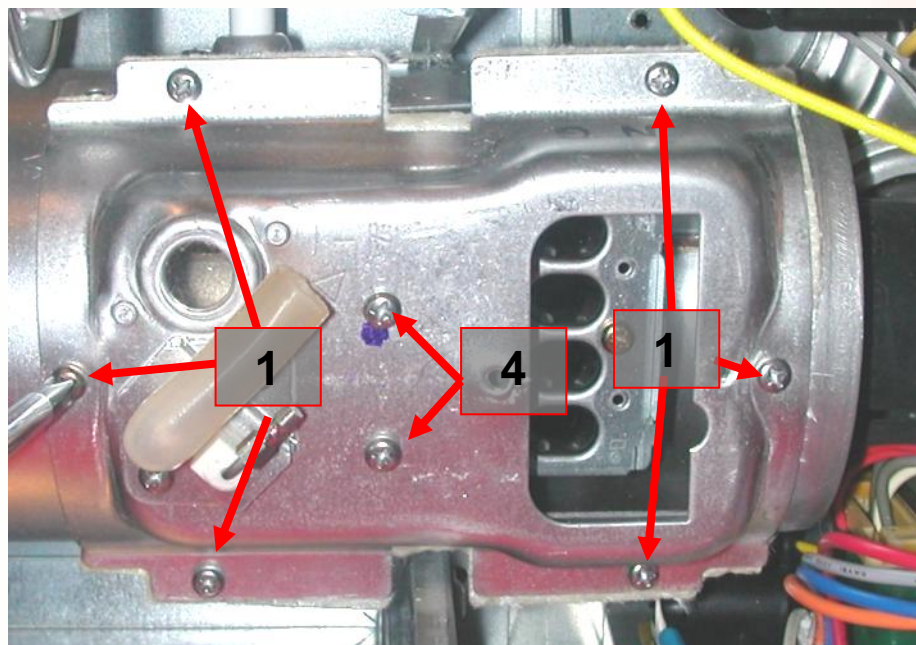
Replace the gasket if it has been compromised in any way!



Burner Box and Cover Plate Removal

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1. Remove six screws on cover plate
2. **NOTE:** If the burner box and cover are removed, their fiber gaskets **MUST** be replaced with new gaskets. This is the gasket that should be replaced under the Retrofit Program.
3. Burner box will slide out of heat exchanger
4. Burner box can be separated from cover by removing two front screws

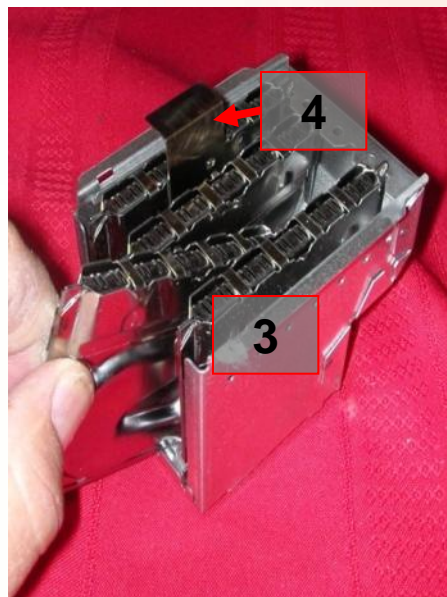
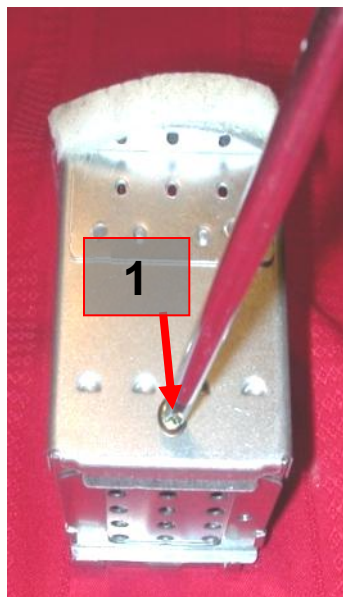


Burner Box Disassembly

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Burner box can be disassembled for inspection (this is rare)

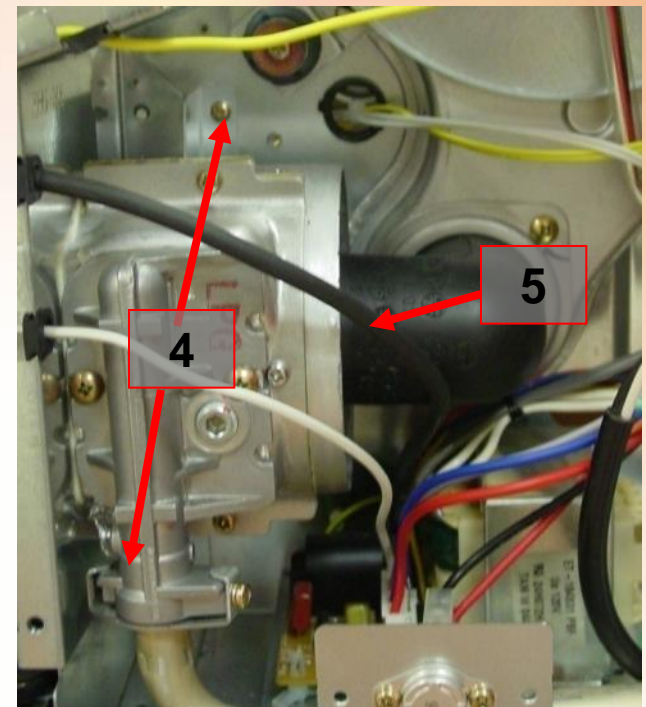
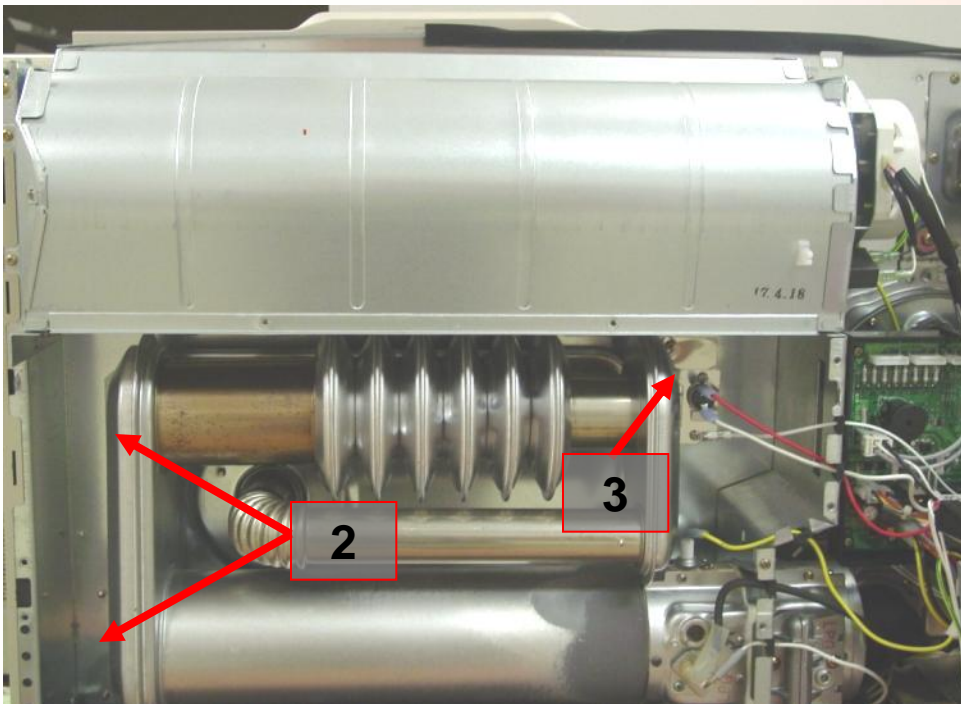
1. Remove single screw on back of burner
2. Remove plate on back of burner
3. Individual burners will come free.
4. NOTE: burner with flame capture plate must be installed in top of box.
This ensures flame rod is capturing the flame correctly.



Heat Exchanger Removal

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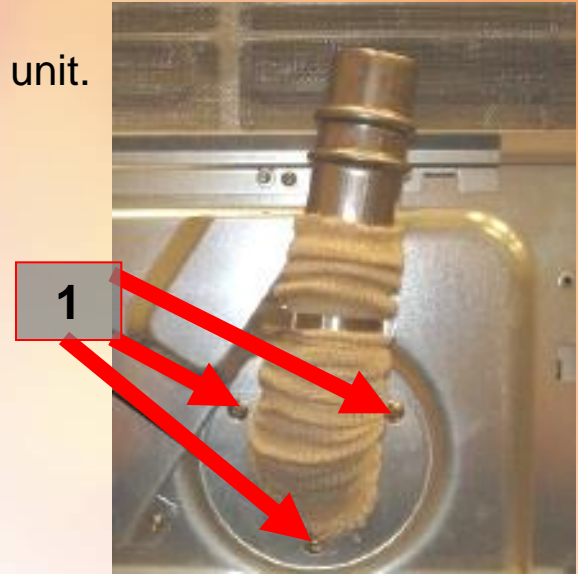
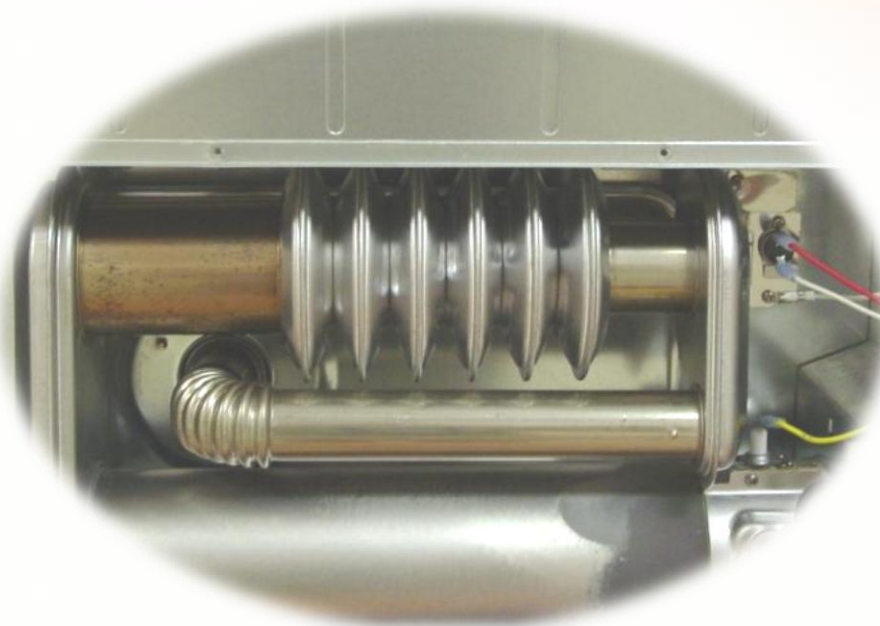
1. Remove front cover, inside panel, warm air seal panel, and burner box assembly, and flame rod, and if needed, convection fan assembly
2. Remove two screws on right of heat exchanger
3. Remove single screw behind overheated bimetal and filter thermistor
4. Remove two screws behind right side of heat exchanger
5. Remove single screw attaching rubber boot to heat exchanger



Heat Exchanger Removal

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1. Remove the three screws holding the exhaust elbow to the unit.
2. NOTE the "O" ring inside the elbow.



The stainless steel heat exchanger and aluminized steel are formed to a bellows style to reduce expansion noise and to provide a larger surface area for efficiency.

RE-ASSEMBLE THE UNITS NOW

Leave the front cover off of the unit

**KEY POINTS FOR TROUBLESHOOTING
HOW TO PHOTOS
DIFFERENT MODEL SPECIFICS**

Verifying electrical values of individual components is not common but when necessary, must be conducted correctly and safely. Verifying incoming supply voltage is the most common metering need in the field—especially during installation.

Key points when troubleshooting electrical values:

- Ensure volt meter probes are solidly contacting metal
- Apply probes to the back of Molex connections when possible to prevent possible damage to connection points
- Know your meter and how to set it for each type of measurement
 - Ω = Ohms or resistance
 - VAC or V_{\sim} = AC voltage
 - Always set meter to next highest value from range (as listed in manual)
 - $K = \times 1000$; ex. $6K\Omega = 6000$ Ohms
 - VDC or V_{-} = DC voltage
 - $\mu = \times .001$; ex. $6\mu A = 0.006$ Amps or 6 microamps
 - A=amps (ensure meter is set to DC current for flame rod measurements)
- When measuring resistance, ensure the component is disconnected from the circuit AND power is removed.
- When measuring a solenoid's resistance, place the meter probes on the solenoid's lugs (connection points) with the wires disconnected from.
- A correct resistance reading from a solenoid or transformer coil is not a guarantee that the component is good as the windings can open under load. An incorrect value is a very good indication that the component is bad though.

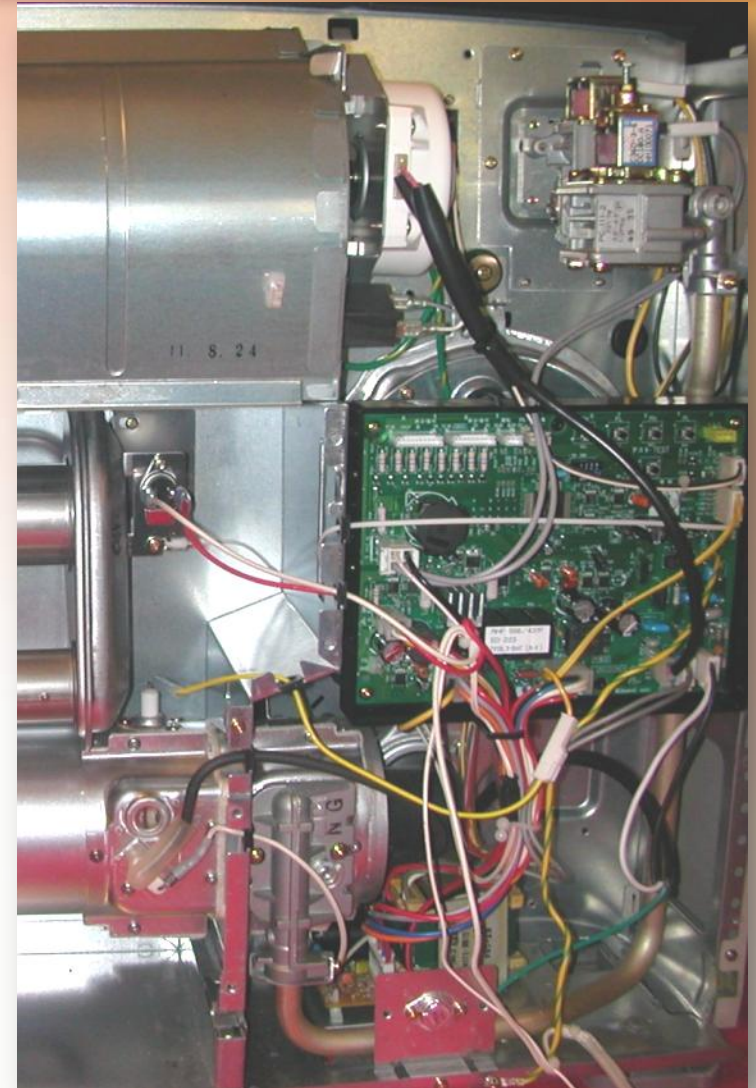
For metering values for models 2008 or older, reference Rinnai's Direct Vent Heater Service Manual

ENSURE YOU ARE READING THE CORRECT PAGE!

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LAB EXERCISE

1. Measure Incoming Voltage
 1. At receptacle or extension cord
 2. At primary of transformer
2. Measure various transformer secondary points (voltage / resistance)
3. Measure Continuity of safety circuit at various
 1. At PCB connection point
 2. If desired, at bottom bimetal
4. Measure Resistance of Solenoids
 1. Measure POV
 2. Measure SV1 and SV2
 1. Is the value half of specification?
5. To measure flame rod current connect meter in series at flame rod Molex connector (yellow wire)—see service manual. Ensure meter is set correctly!



Control Panel Review (C-Series models)

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**EX08C, 11C,
17C, 22C
MODELS**

Temperature Control and Display-
Display will enter a power saving dimmer mode
during normal operation

Restricted
Filter
Indicator

Operation Lamp
Green = standby
Solid red = when flame is present
Flashing red = fault code is present

Child
Safety
Lock

Economy
Feature

Timer 1 and 2
Note: While off, pressing Timer
1 and 2 together will change the
display from F° to C°

Override
Temporarily bypasses timers

Timer and Clock
Setup

Setback
Feature



ES38 MODELS

Economy Feature

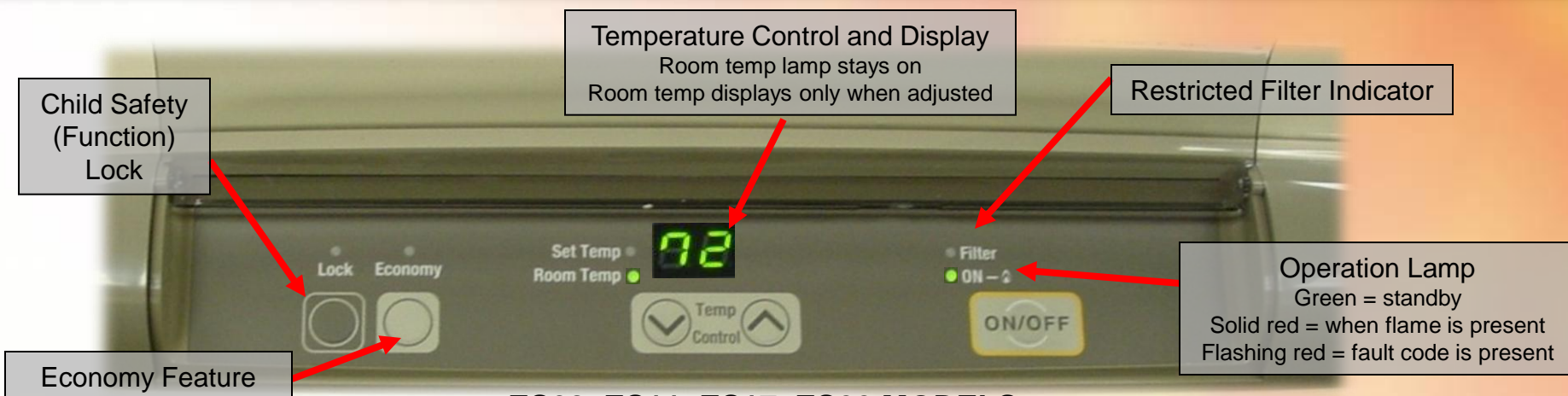
Temperature Control and Display
Room temp lamp stays on
Room temp displays only when adjusted

Function Lock -
Pressing both arrows will engage



Previous Model Control Panel Review

Rinnai



ES08, ES11, ES17, ES22 MODELS



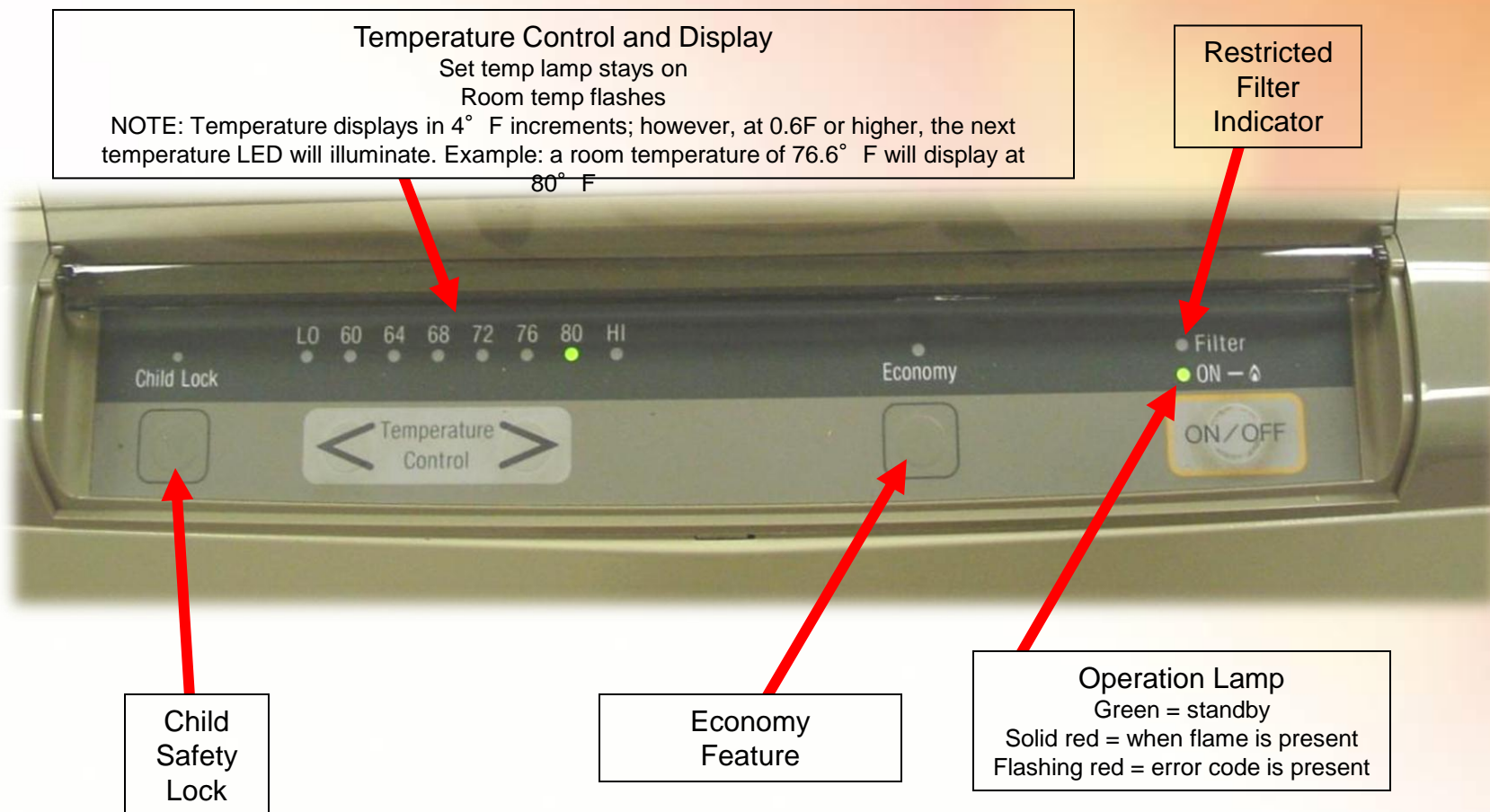
EX17, EX22 MODELS

| | | | | | | | | | | | | | | |
|-----------------------------------|------------|----------------|----|----|----|----|----|----|----|----|----|----|----|----------------|
| Temperature Range of all Controls | Fahrenheit | L (approx. 55) | 60 | 62 | 64 | 66 | 68 | 70 | 72 | 74 | 76 | 78 | 80 | H (approx. 95) |
| | Celsius | L (approx. 13) | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | H (approx. 35) |

Previous Model Control Panel Review

Rinnai

431FA, 431FAII, 431FAIII, 556FA, 556FAIII CONTROL



MAINTENANCE CODE DIAGNOSTICS

- All current model direct vent furnaces have maintenance codes that can post if the unit isn't operating to specification
- In addition to an error code on the display, the flame indication lamp must be flashing
- Models with analog displays will flash a series of LED's to indicate the code
- The last nine error codes can be retrieved from each unit by pressing the Economy and Up/Down Temperature buttons together while the unit is OFF
- Refer to the model's owner's / installation manual or service manual for more information

Maintenance Codes



Operation intervention is required for all codes EXCEPT a code 11 (2009 models and newer).

| ANALOG CODE | DIGITAL CODE | PROBABLE CAUSE | COMMENTS |
|----------------|--------------|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LO-HI | PF | Power Failure | Check power supply |
| 60 | 11 | Ignition Failure | Flame current does not reach 1.0 microamp within the given time after solenoid opens |
| LO | 12 | Flame Failure | Flame current remains below 1.0 microamp for 3 seconds during combustion |
| 68 | 14 | Overheat Safety Device | Bimetals or thermal fuse has activated |
| HI | 16 | Over temperature cut off | Room temperature is sensed as being above 104° F for longer than 10 minutes |
| 72 76 | 31 | Room temp thermistor disconnection | Room temperature thermistor open circuit |
| 76 80 | 32 | Room temperature thermistor short circuit | Room temperature thermistor wire shorted or touching bare metal |
| 64 68 72 | 33 | High limit thermistor disconnection | High limit thermistor open circuit |
| 68 72 76 | 34 | High limit thermistor short circuit | High limit thermistor shorted or touching bare metal |
| LO 60 64 | 53 | Abnormal spark sensed | Sparker not OFF within 20 seconds at time of ignition; 1 st spark sense not within 2 seconds; 2 nd spark sense not within 1 second after solenoid valve opens |
| 60 64 68 | 61 | Abnormal combustion fan motor rpm | Fan speed not achieved within time or goes over speed |
| NA | 62 | Convection fan failure | Ensure convection fan can turn freely (C-Series Models Only) |
| 64 68 | 70 | ON/OFF switch failure | ON/OFF switch connects continuously for more than 15 seconds |
| LO 60 | 71 | Solenoid valve check | Solenoid valve(s) (SV1 & SV2) signal and response signal are different |
| 80 | 72 | Flame rod failure | PCB fails to sense microamps within 20 seconds |
| 72 76 80 HI | 73 | Communication failure | Data transfer within PCB fails |
| NA | 49 | Pressure sensor disconnect or breakdown | Check sensor connection to PCB & hoses to blower motor |
| 60 64 68 72 76 | 99 | Flue block or venting disconnect | Check intake and exhaust inside and outside for blockage or freezing |

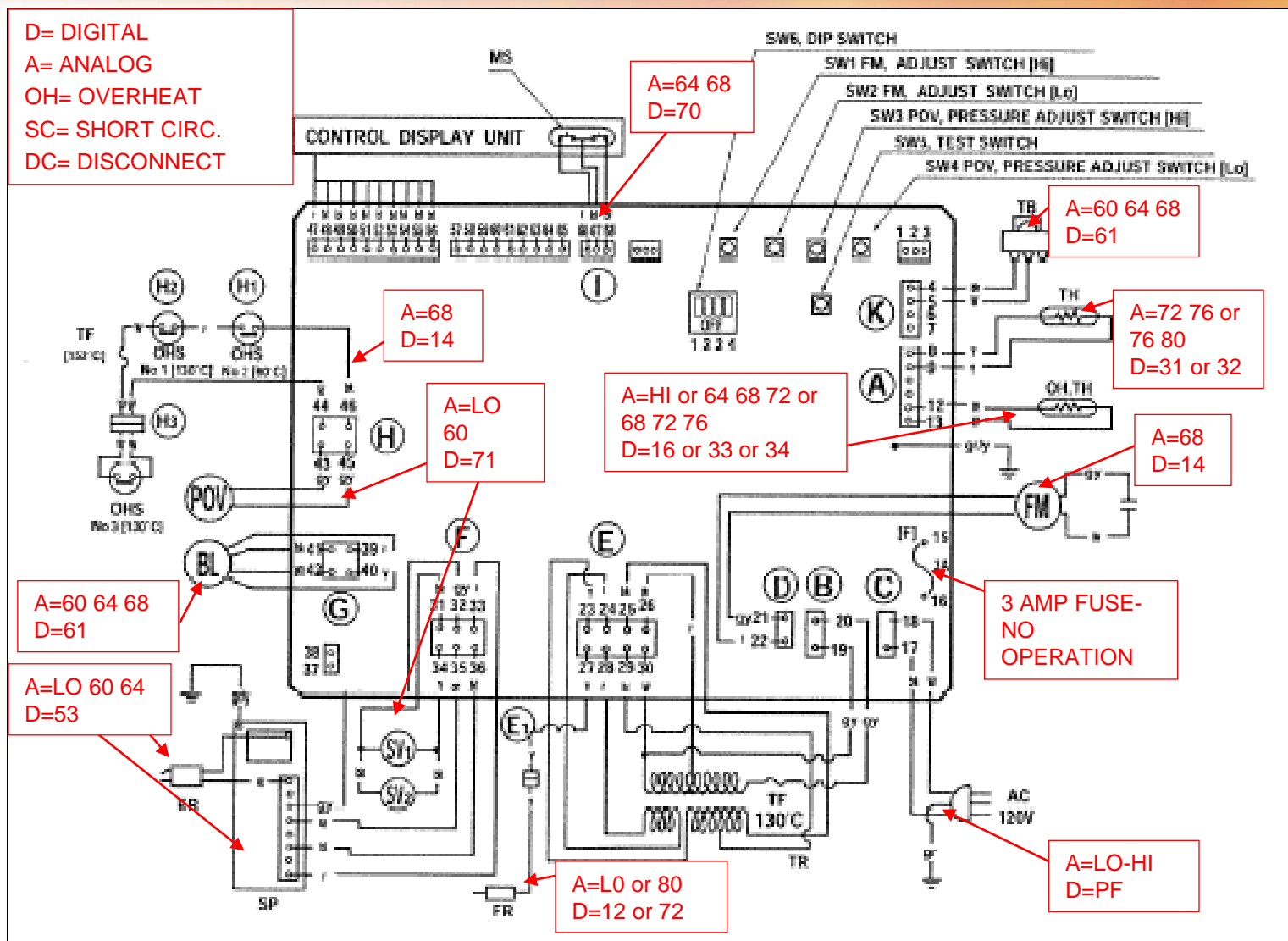
Maintenance Codes

Rinnai

For component
level wiring
diagrams,
reference
Rinnai's Direct
Vent Heater
Service Manual

**ENSURE YOU
ARE READING
THE CORRECT
PAGE!**

D= DIGITAL
A= ANALOG
OH= OVERHEAT
SC= SHORT CIRC.
DC= DISCONNECT



- Conversion kits are available for each model:
 - Older models included the kit with the product
 - Opposite gas type rating plate
 - Opposite gas type orifices
 - Primary and secondary air dampers (model dependent)
 - Instructions for conversion including gas pressure settings
- Gas pressure must be verified if one of the following occur:
 - The gas valve is replaced
 - The PCB is replaced
 - The model's gas type is converted
- Gas pressure setting instructions are in the Direct Vent Service Manual and the unit's conversion instructions

Gas Pressure Settings / Gas Conversion

Rinnai

201 / 263 / 431 / 556 Gas Conversion



Remove the manifold and the burner damper screw.

NOTE: The burner cover does not have to be removed for conversion.

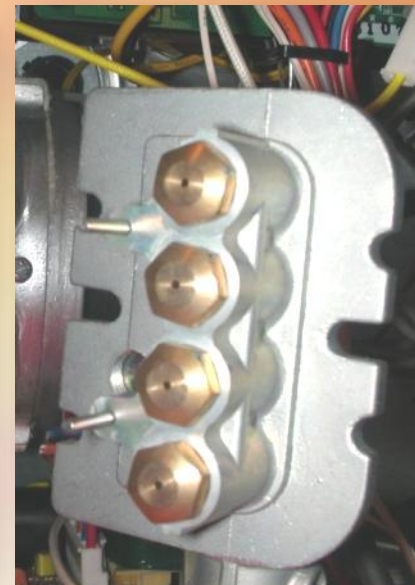
NOTE: Gas Conversion for the 1004 is different. See each model's conversion procedure!



Remove the primary air damper

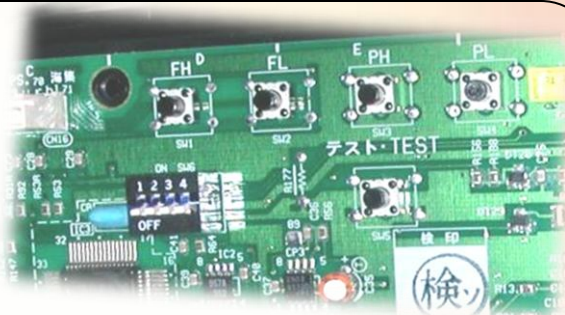


Remove the secondary air damper. Note the tab orientation



Replace the orifices

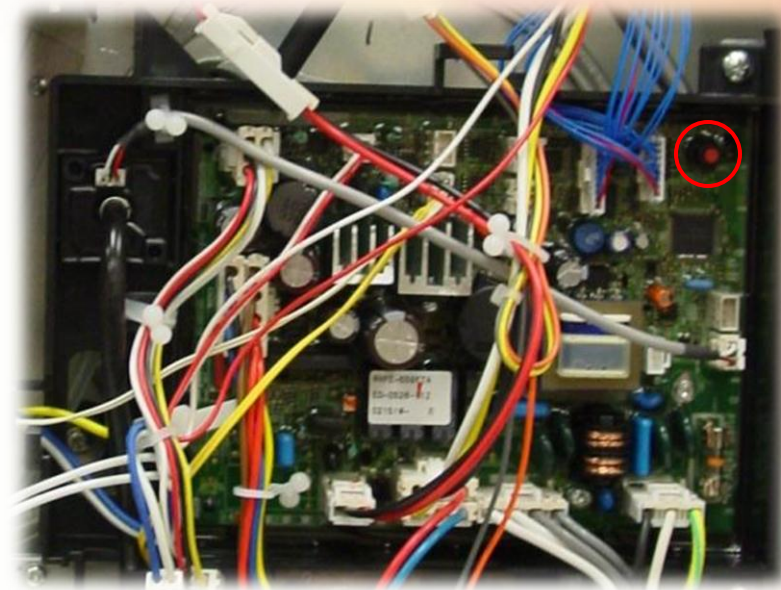
Gas Pressure is set from the PCB.
Follow each model's conversion procedure



Fault Code Flag Function “FF”

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- C-Series models have the ability to allow the service technician to insert an “FF” in to the bank of fault codes.
- This creates a flag of when the technician was present
- It can be used after a routine maintenance or to note when a service call was made in relation to the fault codes within the bank.
- To insert “FF” into the bank, with the unit off, press the “Economy” button on the control panel and the PCB test button at the same time.
- “FF” will then be the most recent fault code
- This cannot be erased after inserted

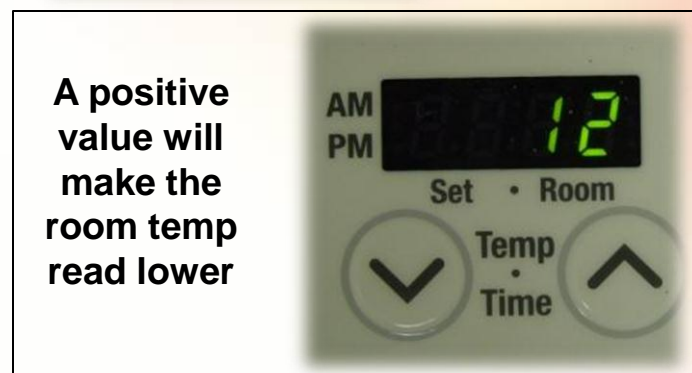
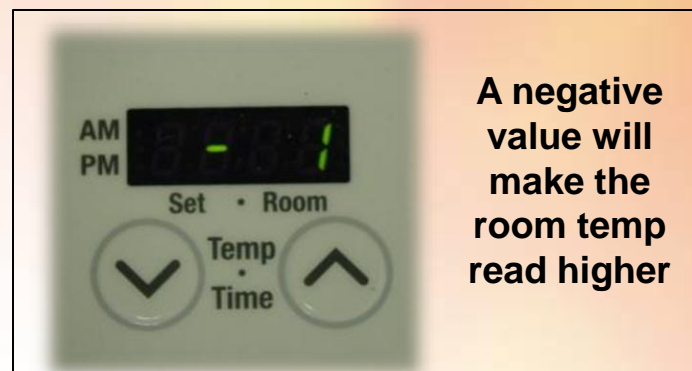


Thermistor Calibration



- C-Series models have the ability to adjust or calibrate the thermistor
- This can be helpful particularly when another thermostat is in close proximity—to ensure the values match if needed
- To adjust the thermistor, with the unit off, press the PCB test button twice
- A number between -12 and +12 will appear—0 is the factory setting
- Each increment is equal to 0.6° F (0.33° C). Use the following chart to adjust to a specific value
- Press the PCB test button once again to record the new value

| A value of : | Will make the control panel room temp read higher by: | A value of : | Will make the control panel room temp read lower by: |
|--------------|-------------------------------------------------------|--------------|------------------------------------------------------|
| -12 | 7.2° F (4.0° C) | 12 | 7.2° F (4.0° C) |
| -11 | 6.6° F (3.66° C) | 11 | 6.6° F (3.66° C) |
| -10 | 6.0° F (3.33° C) | 10 | 6.0° F (3.33° C) |
| -9 | 5.4° F (3.0° C) | 9 | 5.4° F (3.0° C) |
| -8 | 4.8° F (2.66° C) | 8 | 4.8° F (2.66° C) |
| -7 | 4.2° F (2.33° C) | 7 | 4.2° F (2.33° C) |
| -6 | 3.6° F (2.0° C) | 6 | 3.6° F (2.0° C) |
| -5 | 3.0° F (1.66° C) | 5 | 3.0° F (1.66° C) |
| -4 | 2.4° F (1.33° C) | 4 | 2.4° F (1.33° C) |
| -3 | 1.8° F (1.0° C) | 3 | 1.8° F (1.0° C) |
| -2 | 1.2° F (0.66° C) | 2 | 1.2° F (0.66° C) |
| -1 | 0.6° F (0.33° C) | 1 | 0.6° F (0.33° C) |



Convection Fan Overrun Time



- The convection fan will run for a predetermined amount of time to allow the heat exchanger to cool down appropriately
- This time is based upon the stage of combustion the unit is operating in when post purge begins (either due to a satisfied thermistor or power off)
- If a fault code 14 is present, the convection fan will run 255 seconds regardless of the combustion stage

NOTE: The combustion fan slowly ramps down and off immediately when the gas valve closes

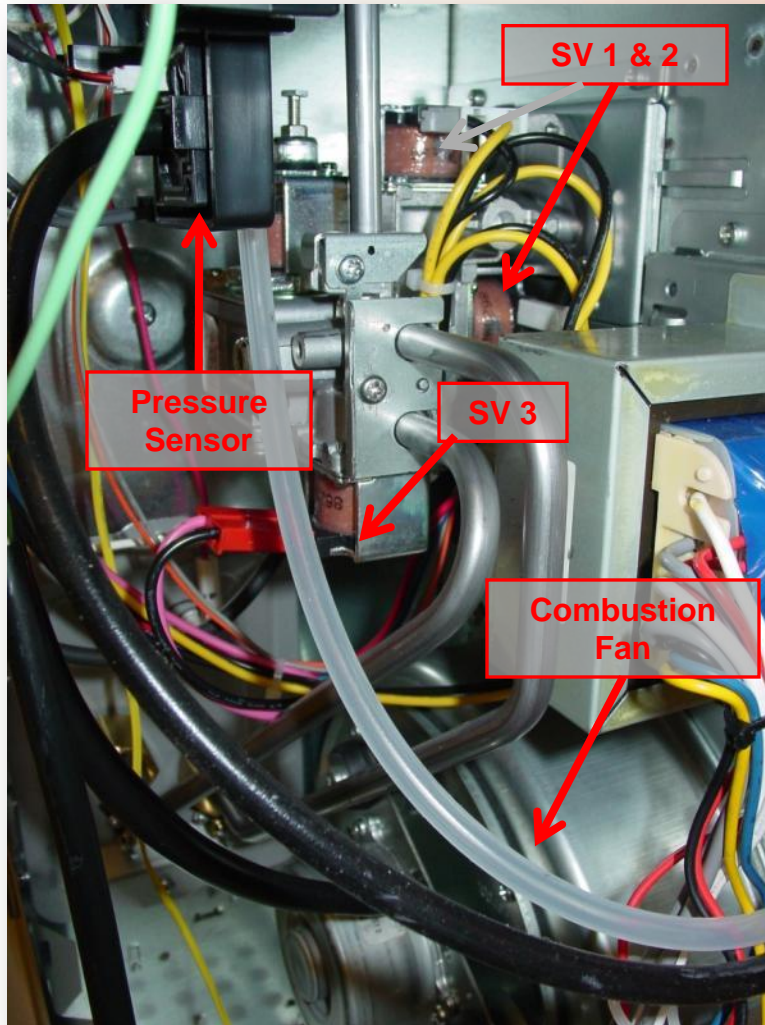
Number of Seconds for Convection Fan Post Purge Time

| | EX08C | EX11C | EX17C | EX22C | ES38 |
|-----------------------------------------|-------|-------|-------|-------|------|
| Within the first 40 seconds of ignition | 120 | 120 | 120 | 120 | 60 |
| Combustion Stage – 1 | 210 | 210 | 210 | 210 | 140 |
| Combustion Stage – 2 | 210 | 210 | 210 | 210 | 150 |
| Combustion Stage – 3 | 210 | 210 | 210 | 210 | 170 |
| Combustion Stage – 4 | 210 | 210 | 210 | 210 | 180 |
| Combustion Stage – 5 | 210 | 210 | 210 | 210 | 190 |
| Combustion Stage – 6 | 210 | 210 | 210 | 255 | 200 |
| Combustion Stage – 7 | 255 | 255 | 210 | 255 | 210 |

- SPECIAL NOTES -

**EX08, EX11, and EX38
Models**

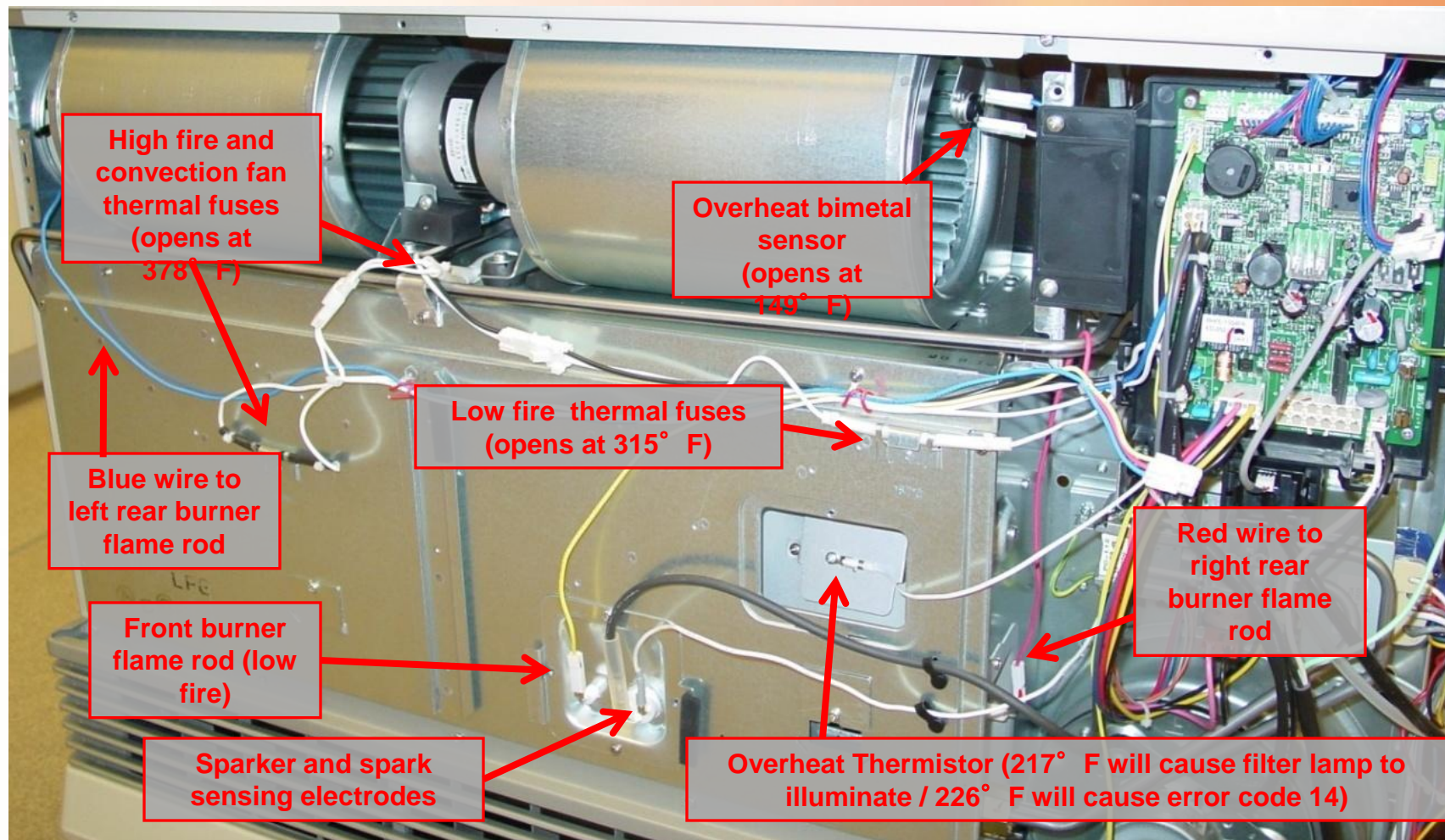
RHFE 1004 / ES38 Overview



- When the ignition sequence starts, the PCB must first see feedback from the combustion fan proving it is turning at the correct speed AND the pressure sensor must be in the correct position to prove adequate air is moving through the vent system. If not, the unit will not continue the ignition sequence.
- When the ignition sequence occurs, the PCB must sense the ignition spark in the correct location before the gas valve will open. If not, the unit will not allow gas to flow and the ignition sequence will cease.
- There are two main solenoid gas valves in series for redundancy. (SV1 and SV2). During non-operation both are closed. For a leak to occur, both would have to fail. Even then, as this is sealed combustion, gas would move through the sealed heat exchanger and out the exhaust vent.
- There are three burners. Each has its own flame rod. If gas is being allowed to one of these burners, the PCB must receive the correct feedback from that burner's flame rod to ensure the flame is of the correct characteristic. If the flame is not adequate, operation will immediately cease.
- For the unit to stage into high fire and allow gas to the two rear burners, SV3 (solenoid valve 3) must open. Once it does, the rear flame rods must detect flame within a set amount of time or operation will cease.

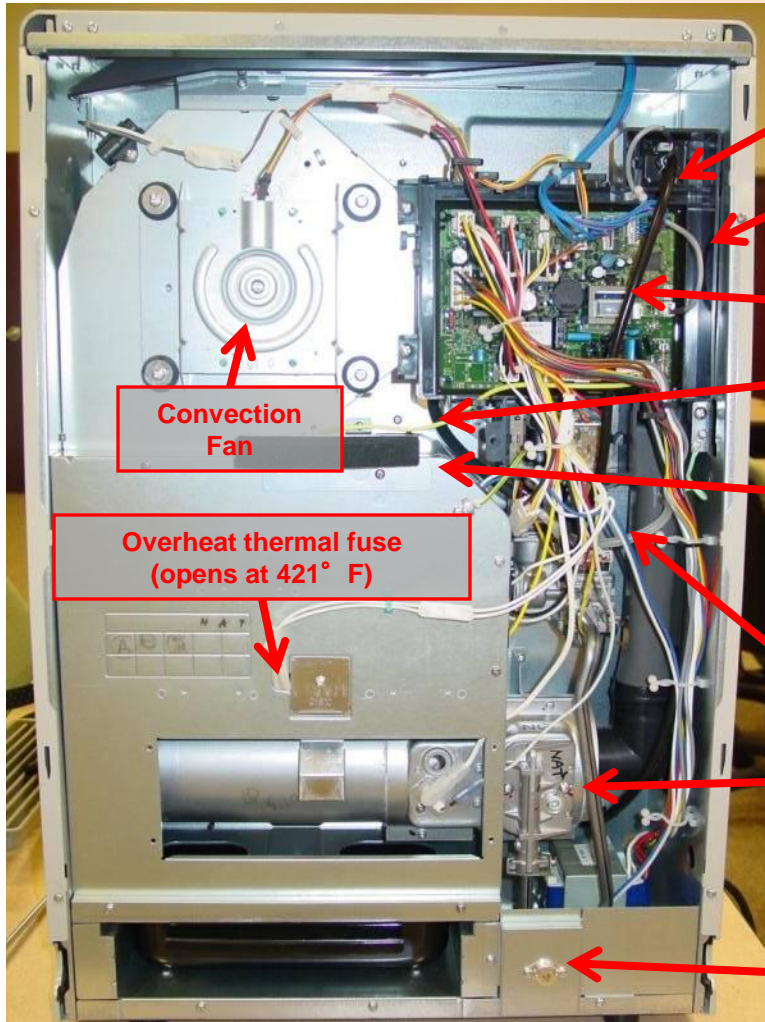
RHFE 1004 / ES38 Overview

Rinnai

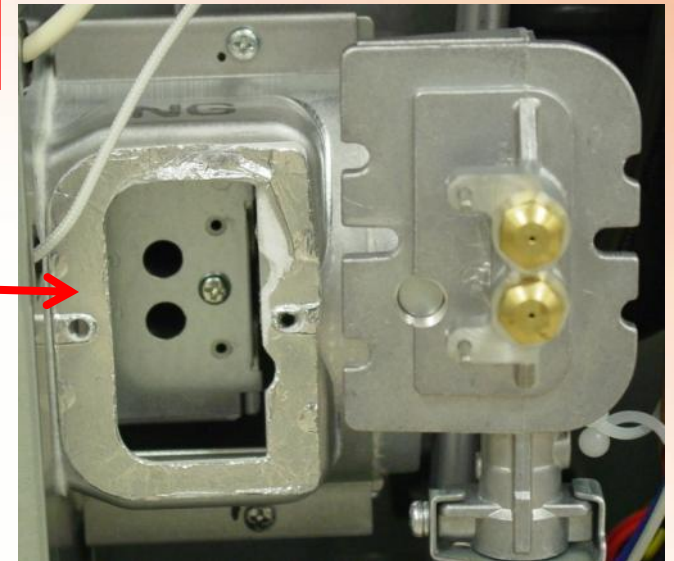


RHFE 201,263 / 08,11 Series Overview

Rinnai



1. These units use the same basic sequence of operation as the 17/22 series
2. The primary difference is the manifold: only two orifices instead of four



APPENDIX A

PRODUCT DISASSEMBLY AND COMPONENT REVIEW

**The following procedures are for
EX17C / EX22C**

Service Procedures for other models will vary

Please stay with the presentation

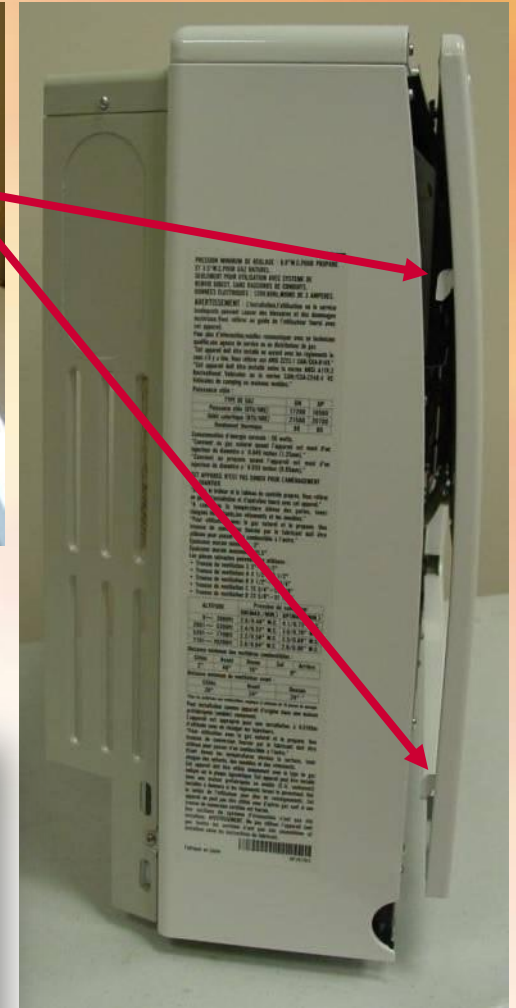
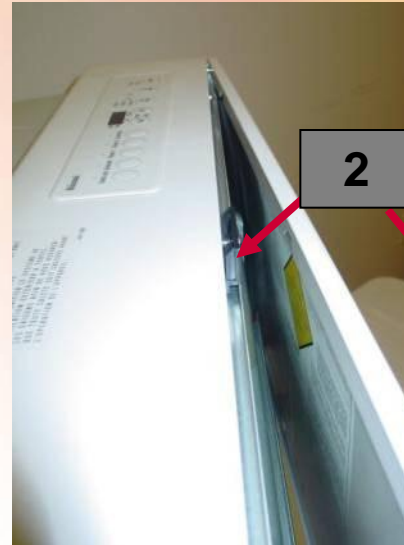
Disassembly / Component Review

Rinnai

1. Remove toe kick from bottom front of unit



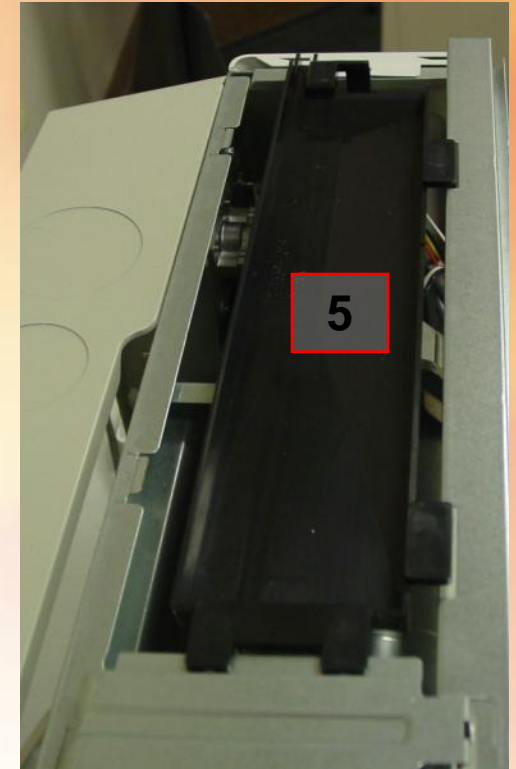
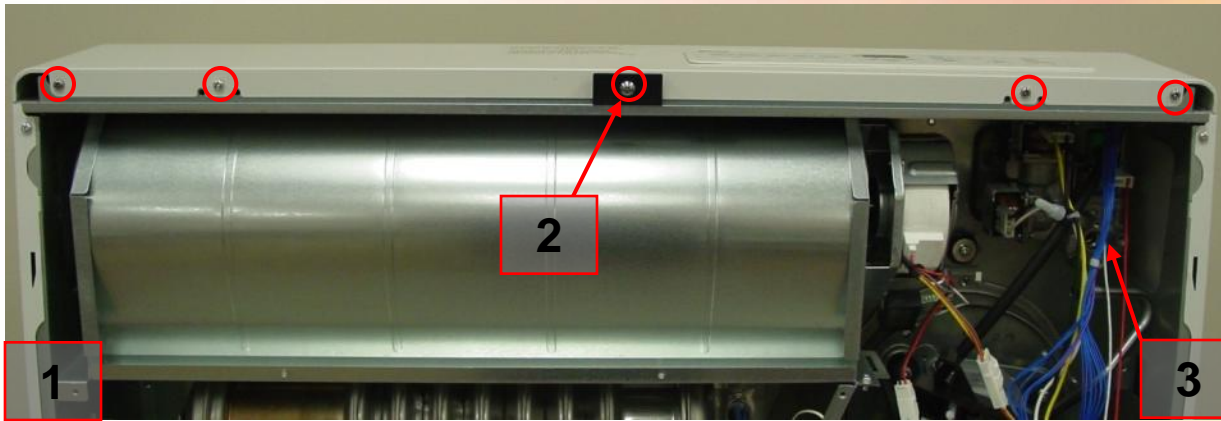
2. Slide the humidifier tray from bottom left of unit—tray will release

Rinnai®

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Control Panel Removal

Rinnai



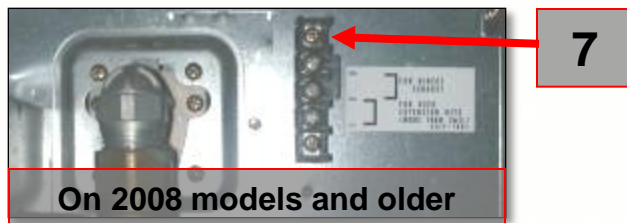
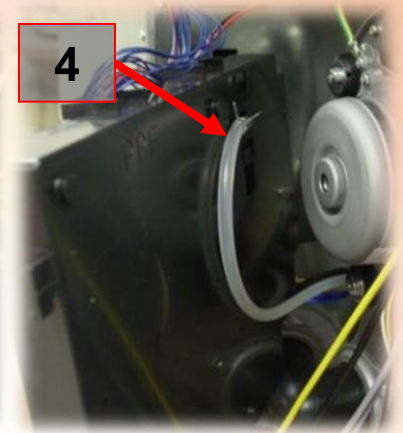
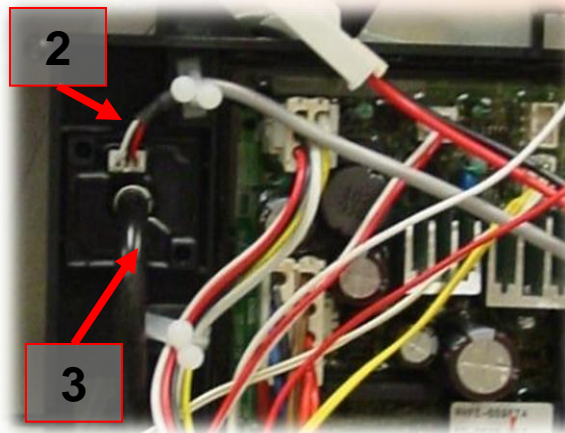
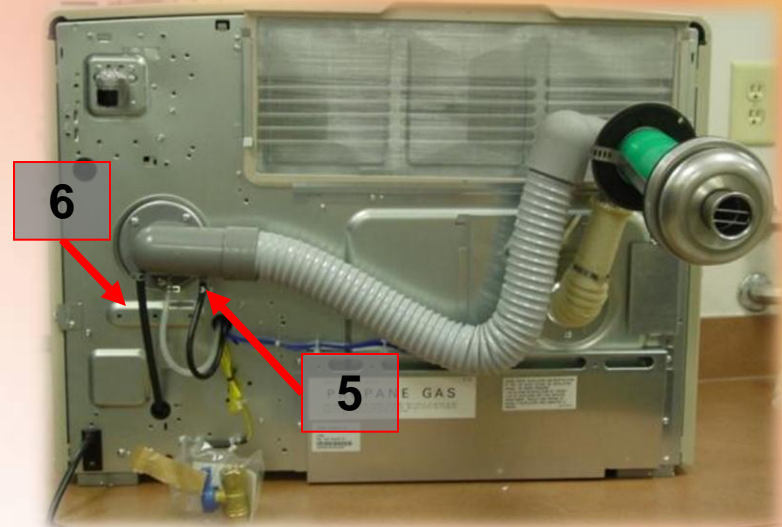
1. Remove the top 5 control panel screws
2. Note the plastic alignment piece on the center screw
3. Disconnect control wiring from PCB
4. Pull forward, then up on top panel to remove
5. Control panel has plastic cover underneath it to protect the PCB from spills on top of unit



Pressure Sensor

Rinnai

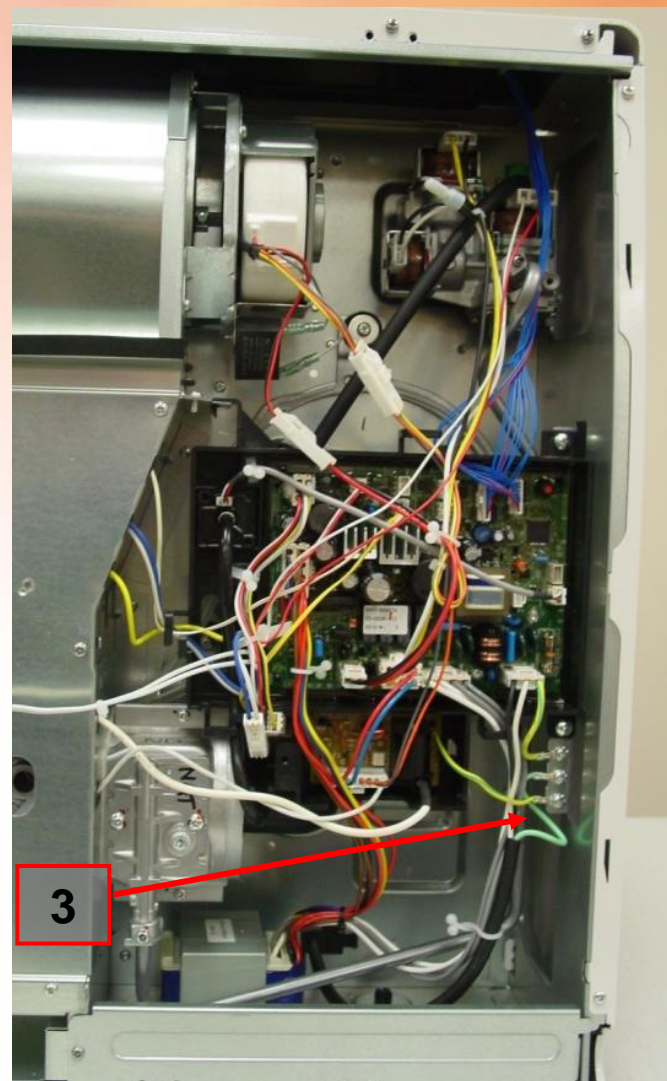
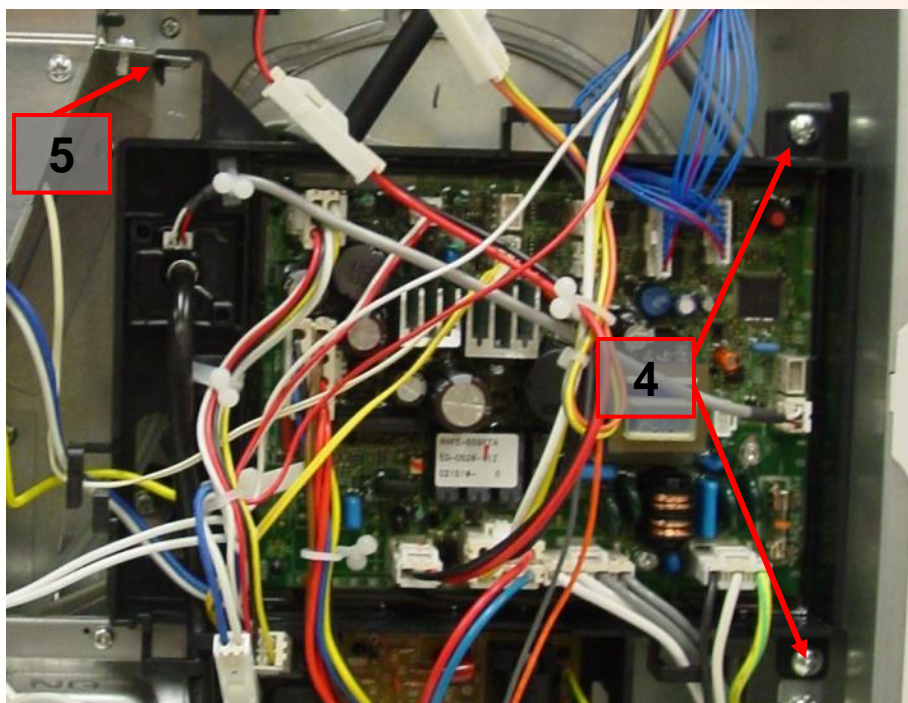
1. Beginning in 2009, all models use a pressure sensor to ensure proper air movement through the burner, heat exchanger, and vent system
2. The pressure sensor snaps in the PCB case. It is not included with a replacement PCB. It should be moved to the new PCB's casing when replacing
3. The black tube connects on the front of the PCB
4. The clear tube connects on the back of the PCB
5. On the back of the unit, these tubes connect to the intake of the vent system—the black hose connection is labeled, “BLK”
6. NOTE: Do not confuse the gas valve pressure balancing tube connection with the pressure sensor connections
7. Due to this pressure sensor, the vent-length termination block (on previous units) is no longer needed



PC Board Removal

Rinnai

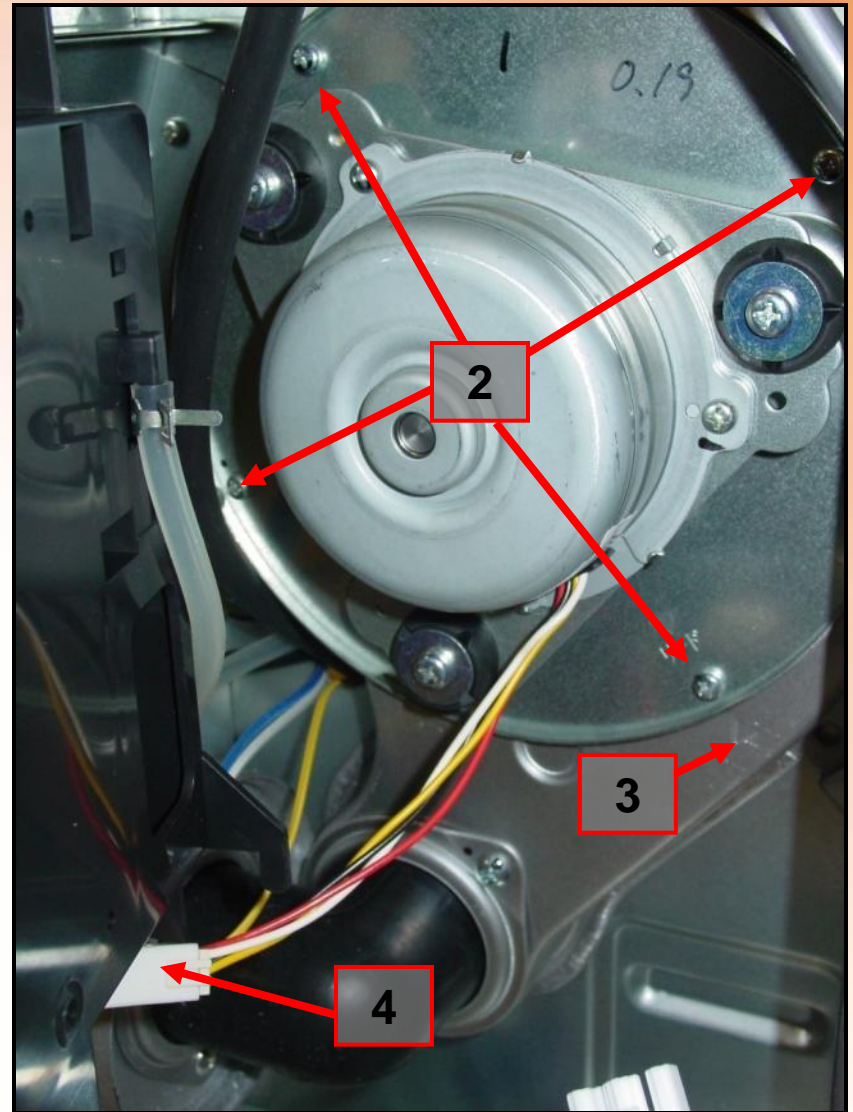
1. Isolate unit from power and gas
2. Remove all wires from PCB. All connectors to PCB have a release point on the Molex
3. Remove grounding wires from right
4. Remove two screws on right of PCB assembly
5. Lift up on PCB and unhook tab on left side freeing PCB from unit



Combustion Fan Removal

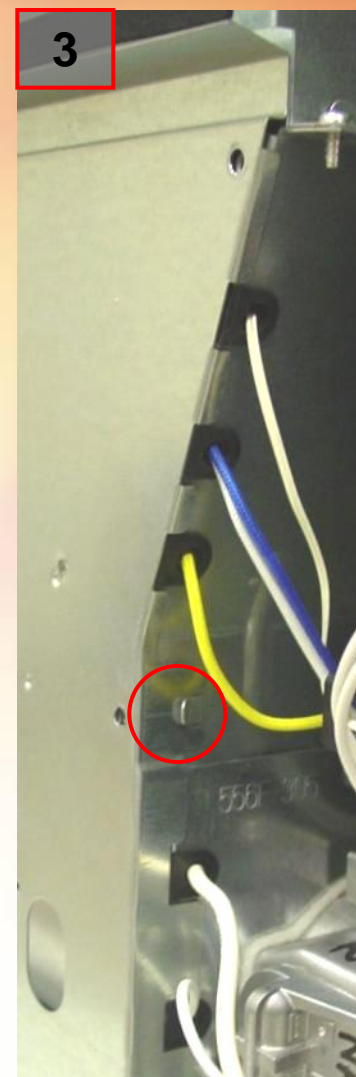
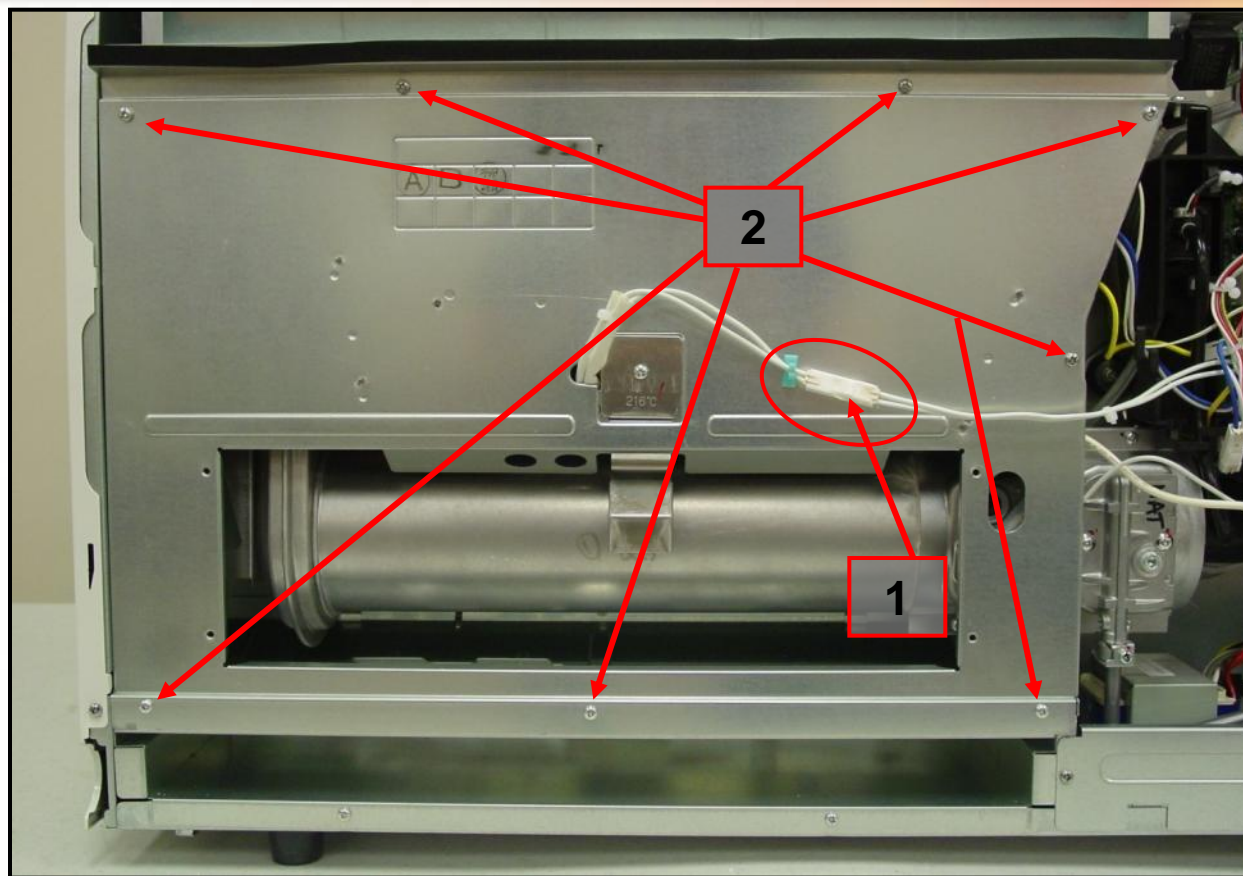
Rinnai

1. 2010 models do not have a grounding wire on the combustion fan
2. Remove the four screws on the inducer motor plate
3. Note the indicator marks in the 5:00 o'clock position for alignment
4. 2010 models now have a Molex connector on the combustion fan



Inside Panel Removal

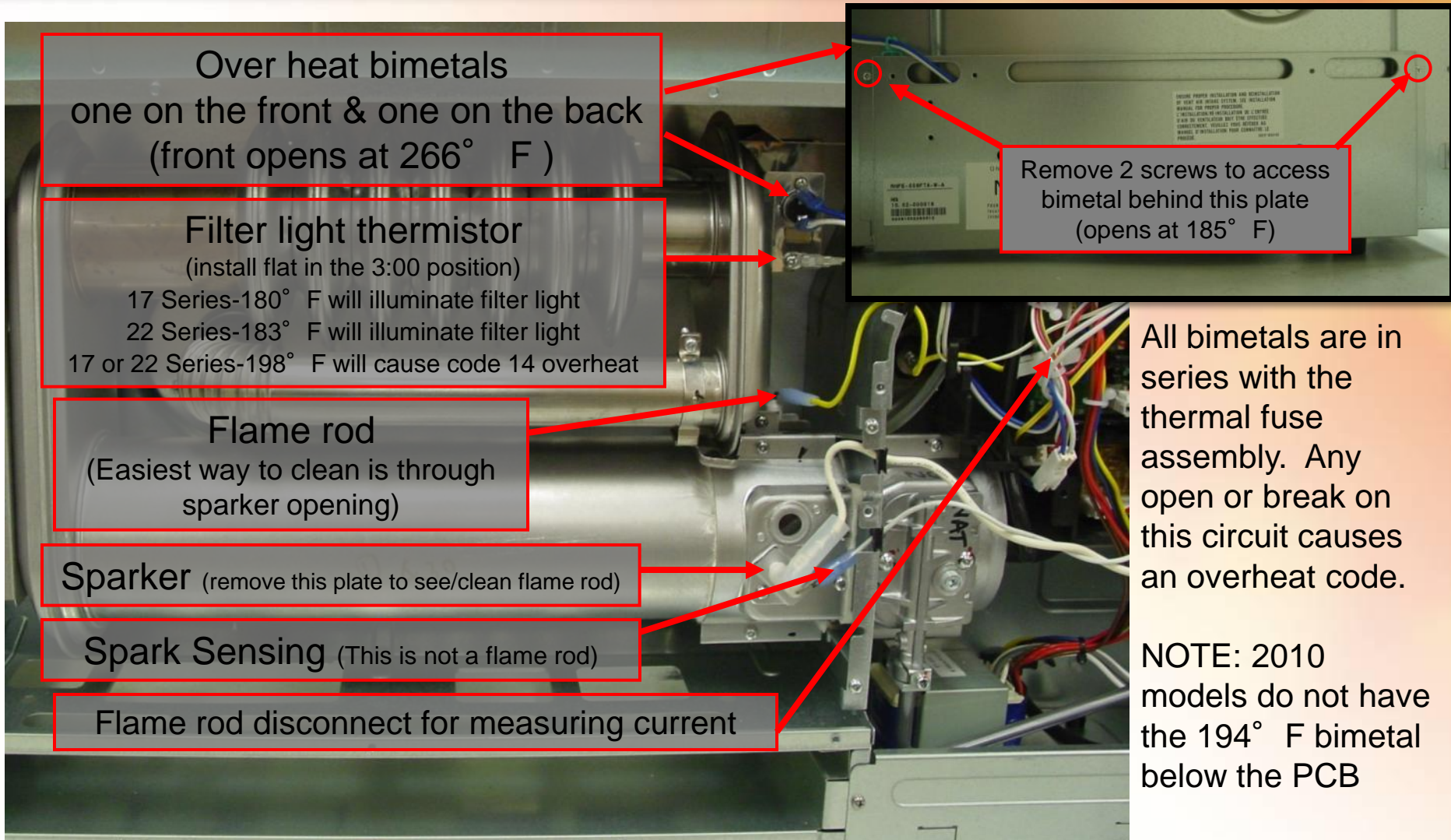
Rinnai



1. Disconnect thermal overhear fuse Molex connector. Fuse opens at 421° F.
2. Remove 8 screws to remove inside panel
3. Ensure the panel seats in all tabs upon reassembly

Safety Component Review

Rinnai

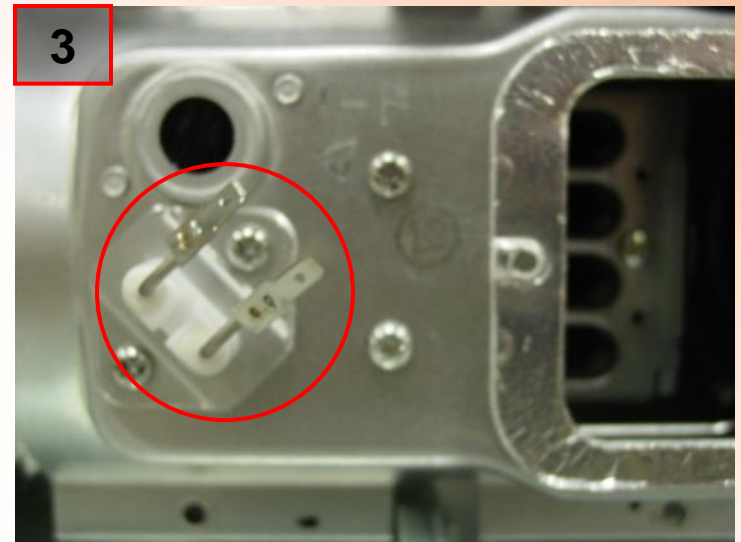


Safety Component Review

Rinnai



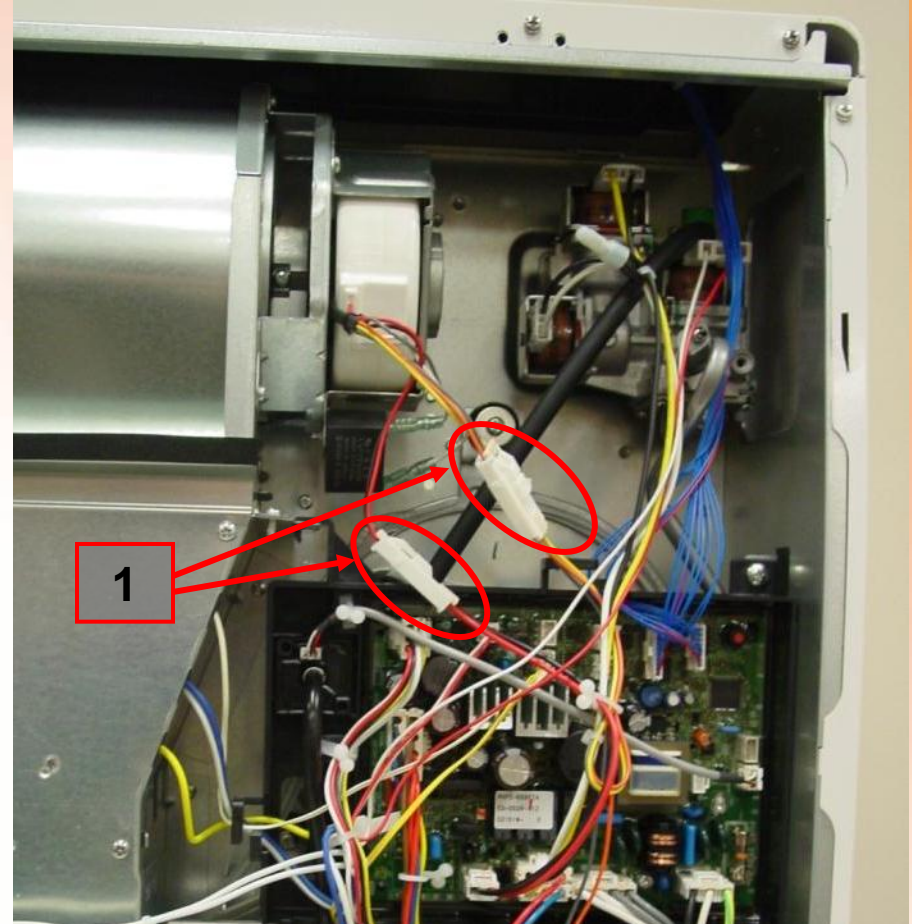
1. The flame rod now has a single screw accessible from the front.
2. The flame rod is now held by a plate. Plate has two tabs at the back that **MUST** seat in slots on heat exchanger.
3. The sparker and spark sensing connections are now the same. Interchanging these wires should not affect performance
4. The sparker and spark sensing wires are both white



Convection Fan Removal

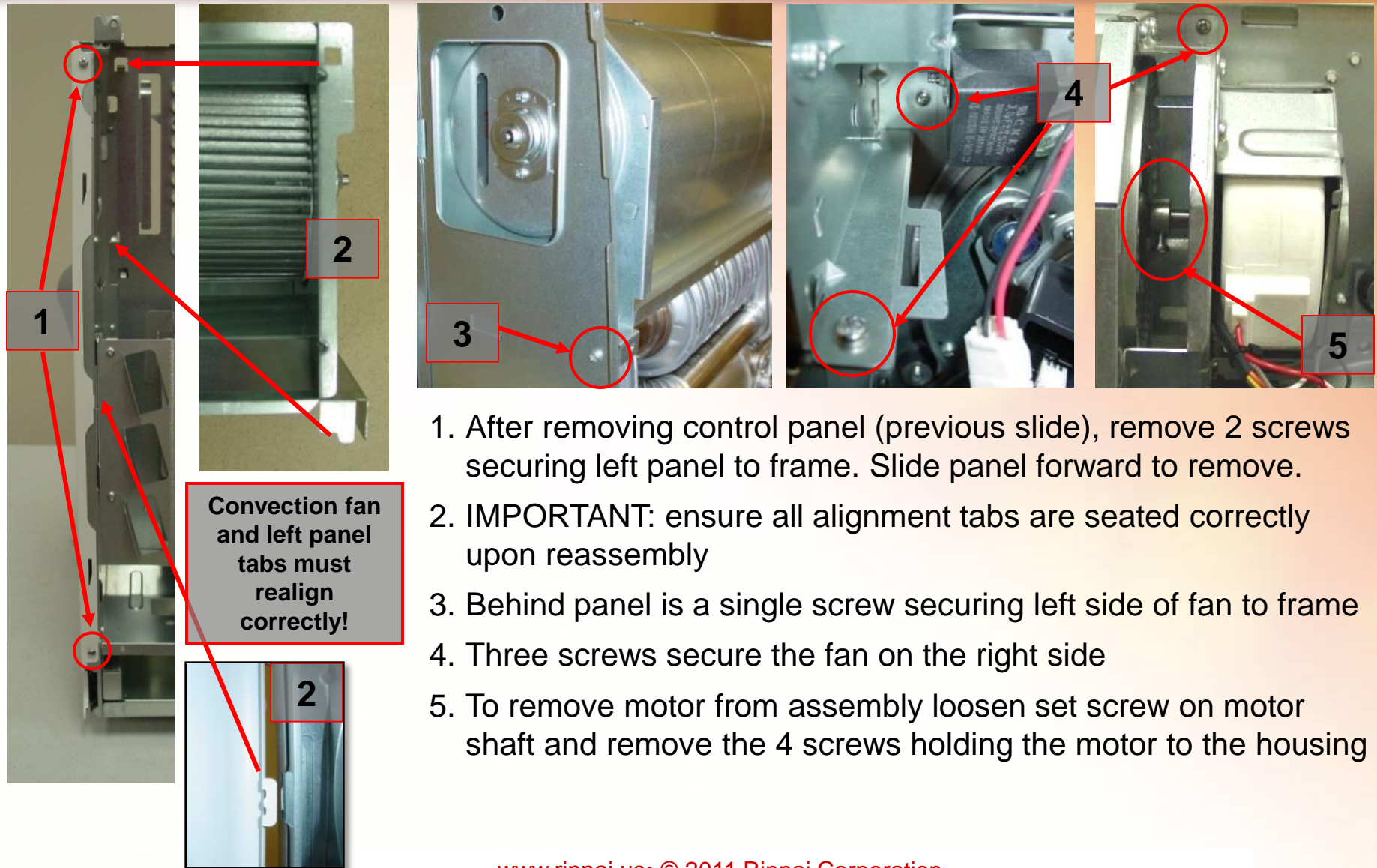
Rinnai

1. 2010 models now have a feedback signal returning to the PCB. Should an inadequate fan speed be detected, the unit could post a fault code 62.
2. The tangential wheel design is quieter in comparison to a centrifugal style blower



Convection Fan Removal

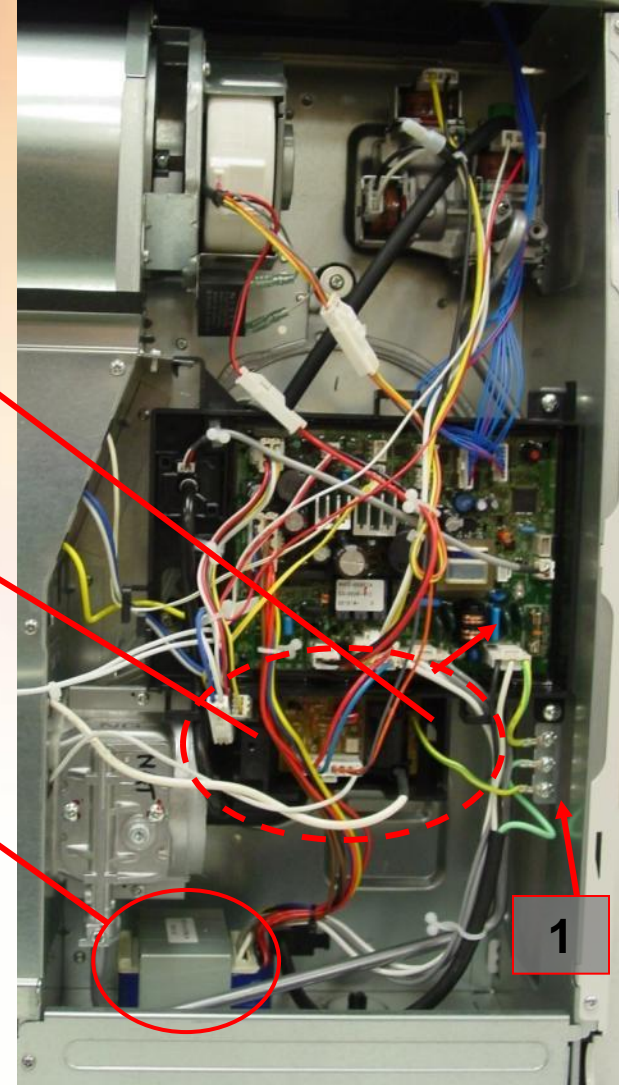
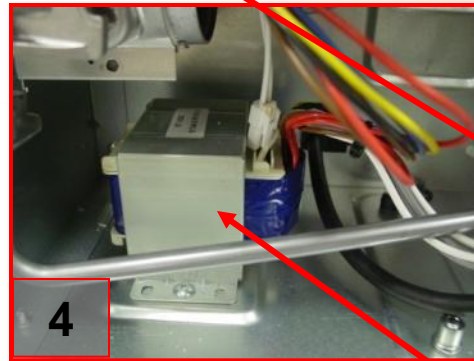
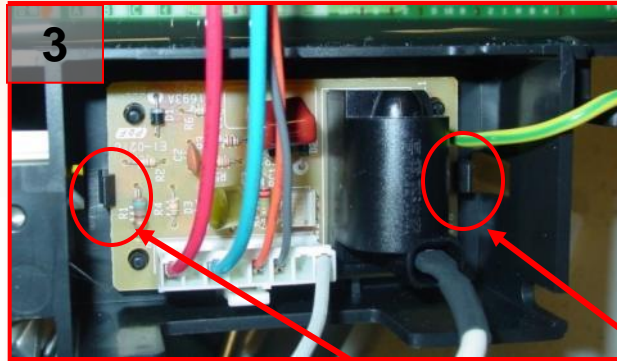
Rinnai



Spark Module / Transformer Review

Rinnai

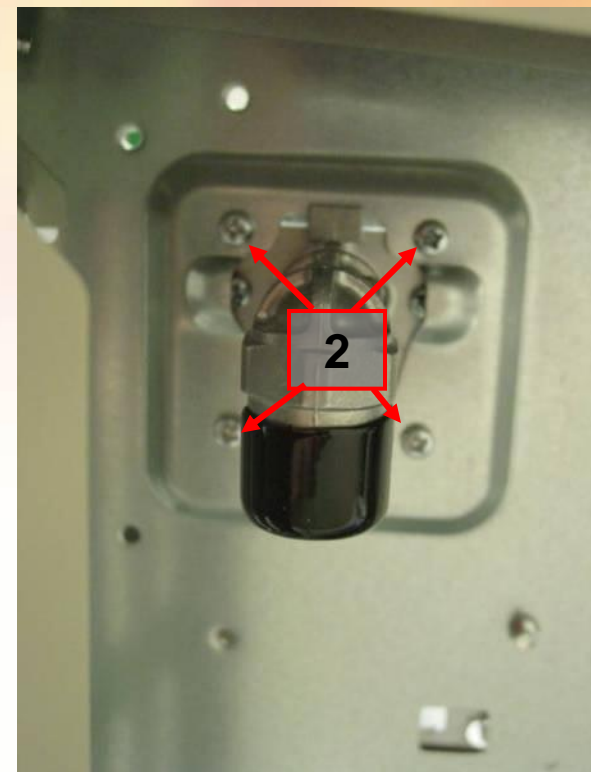
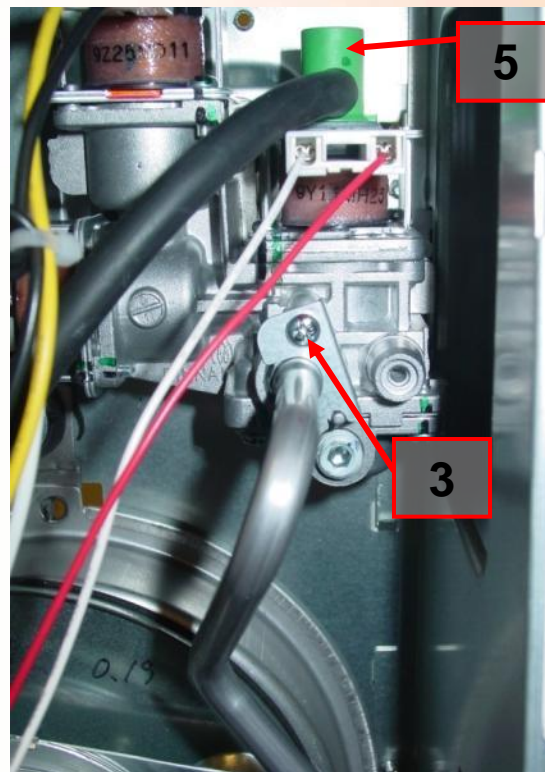
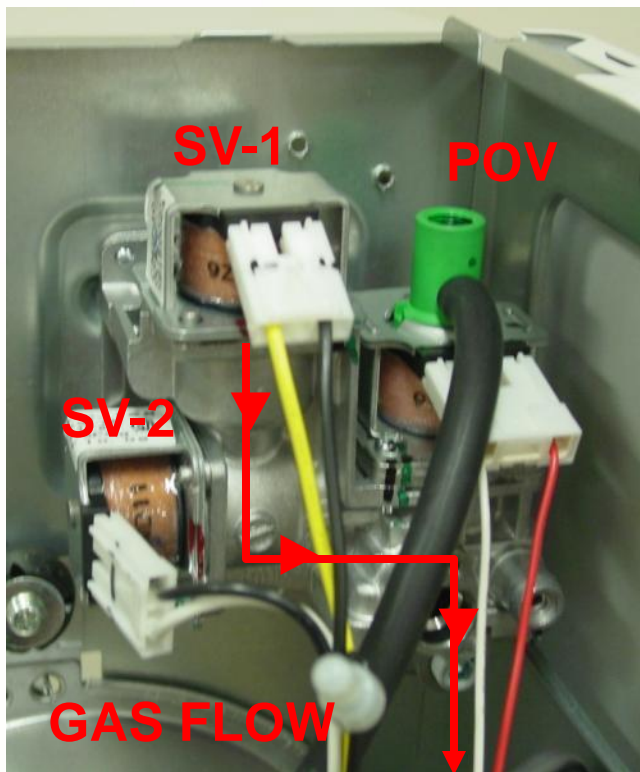
1. Ensure all power, gas and grounding screws are removed
2. The spark module is now in the PCB casing.
3. To remove, release the two tabs securing the module sub PCB
4. To remove the transformer, remove single screw securing transformer to frame. Note tab fitted into slot on rear of transformer.
5. Spark module operation:
 - a) 85-110VAC is applied to the module from the PCB via the blue and red wires.
 - b) Voltage is stepped up at the module and applied in the burner via the white wire depending on model.
 - c) If the spark occurs correctly, the voltage is returned to the module via the white wire.
 - d) Voltage is returned to the PCB via the gray and orange wires thus allowing the gas valve to open.



Gas Valve Assembly Removal

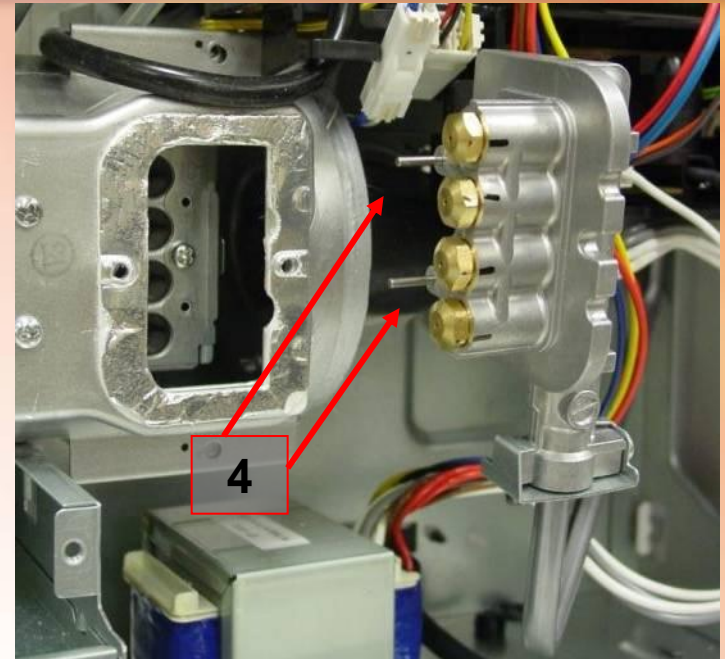
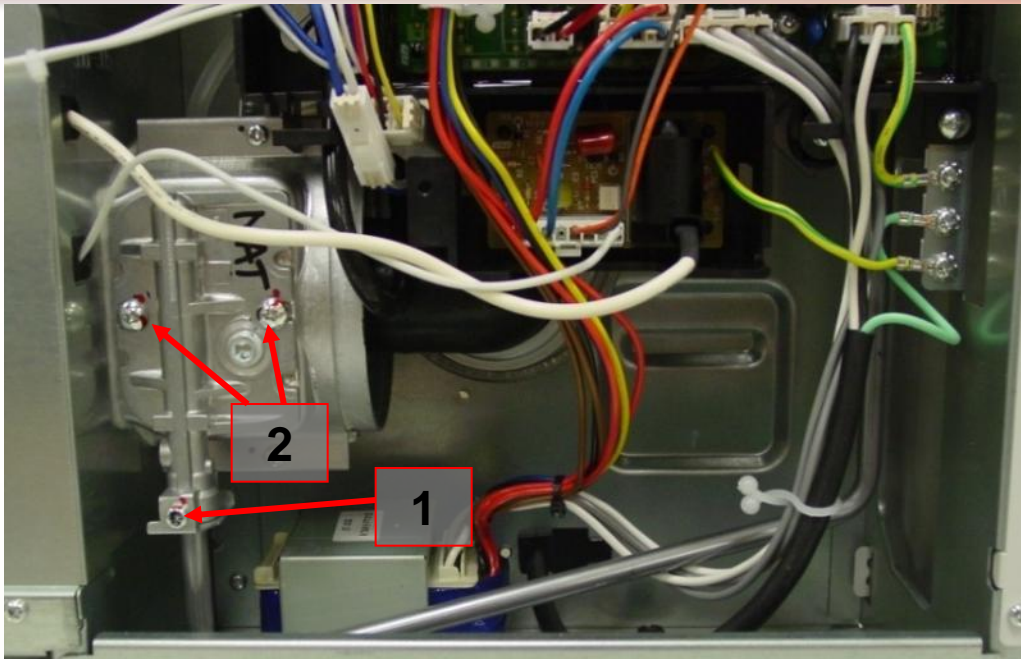
Rinnai

1. Turn off power and gas supply. Disconnect gas supply if needed.
2. To remove, remove 4 screws on back of unit (ensure correct screws are removed)
3. Remove single screw at gas tubing. Remove tube, ensure o-ring is intact.
4. Note gasket and o-ring where assembly connects
5. NOTE: POV screw should only be adjusted during replacement or under Rinnai direction
6. 2010 models: SV1 and SV2 no longer share a wire harness



Gas Manifold Removal

Rinnai



1. Remove single screw and gas tube from manifold (2010 model manifold plates will not “swing out” as previous models). Ensure o-ring remains on tube and is intact.
2. Remove two screws holding manifold
3. Gently pull manifold out for access to venture openings and orifices
4. Upon reassembly, ensure alignment pins are seated correctly
5. For nuisance flame related errors, carefully burn-out venture openings with a propane torch and blow out crystallized remnants with high air pressure. This will ensure no spider webs have settled in openings. Also ensure tube is clear.

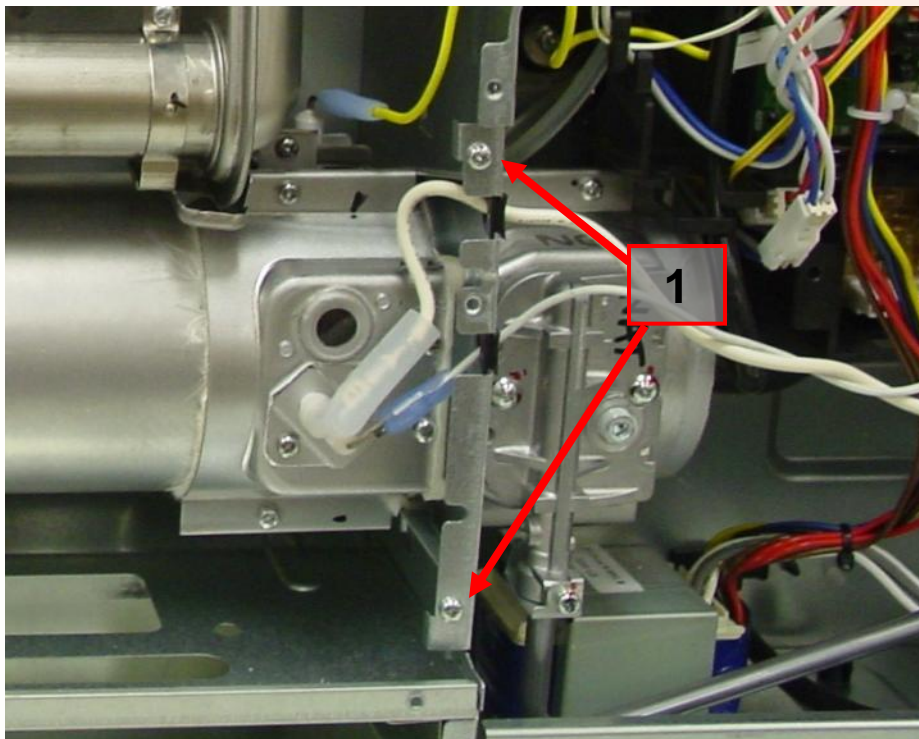
Warm Air Seal Panel Removal

Rinnai

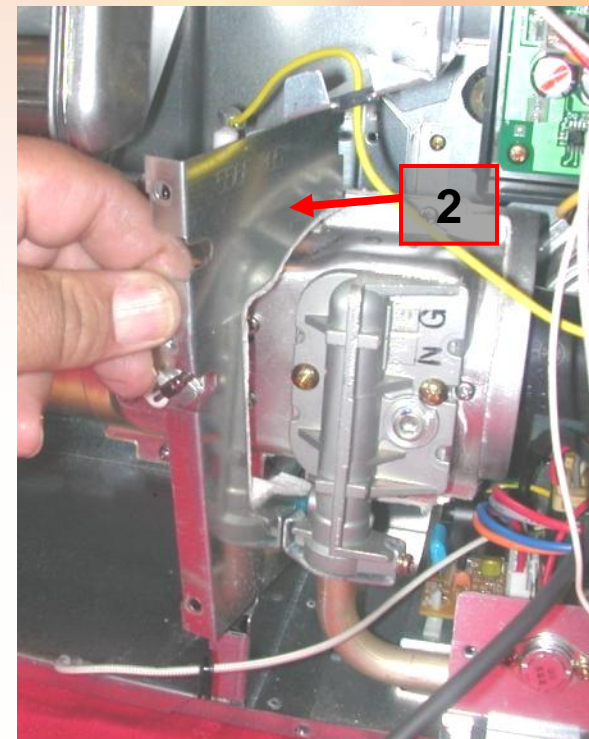
1. Remove 2 screws from panel. **NOTE:** Prior to 2010, bottom screw was removed with front cover.
2. Pull panel free
3. Panel fiber gasket must remain intact. Replace if the gasket has been compromised in any way.



3



1

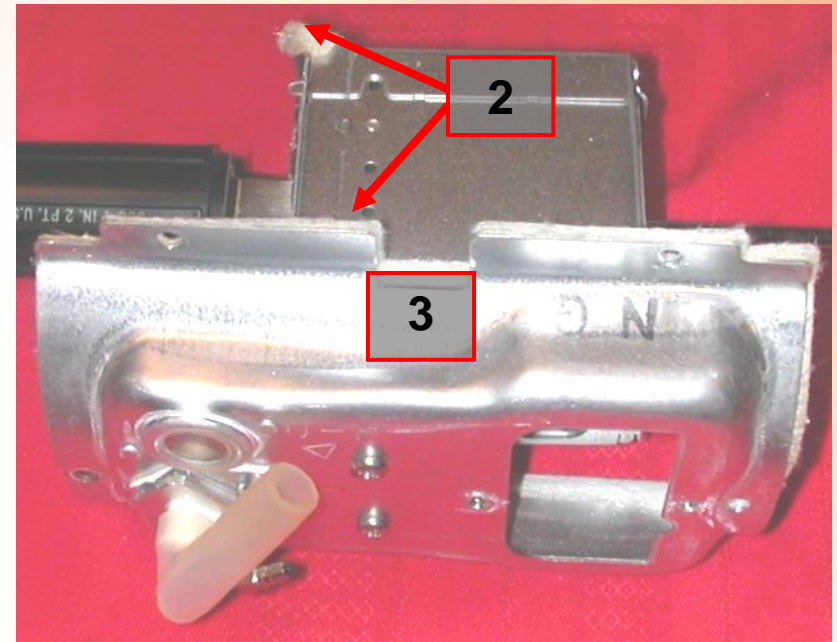
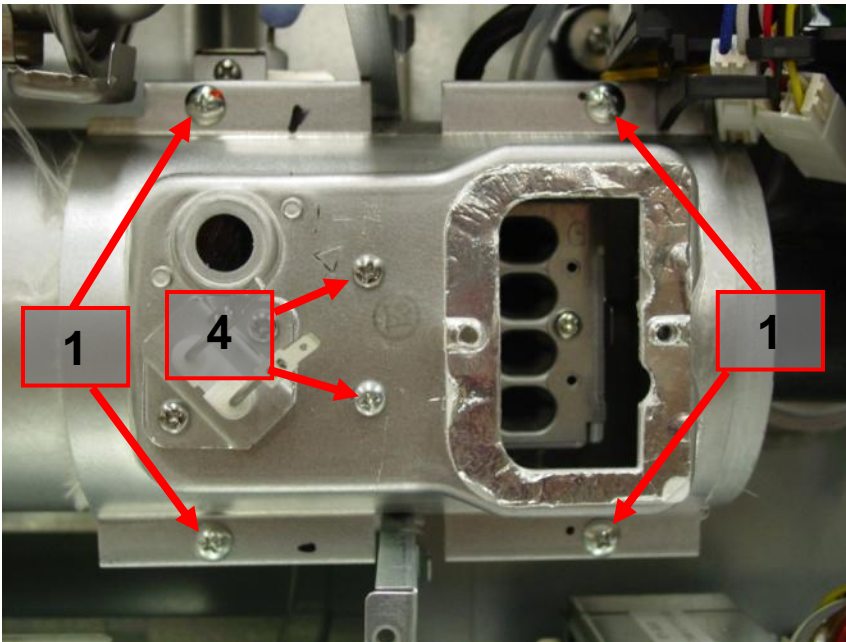


2

Burner Box and Cover Plate Removal

Rinnai

1. Remove manifold plate (previous slide)
2. Remove four screws on cover plate (models prior to 2009 had six screws)
3. **NOTE:** If the burner box and cover are removed, their fiber gaskets **MUST** be replaced with new gaskets. This is the gasket that should be replaced under the Retrofit Program (2000-2007 models only).
4. Burner box will slide out of heat exchanger
5. Burner box can be separated from cover by removing two front screws

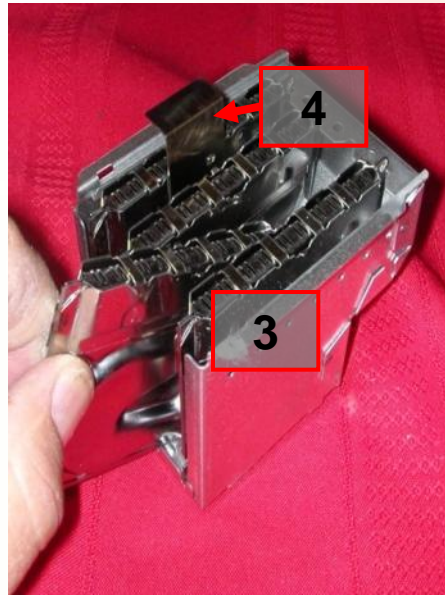
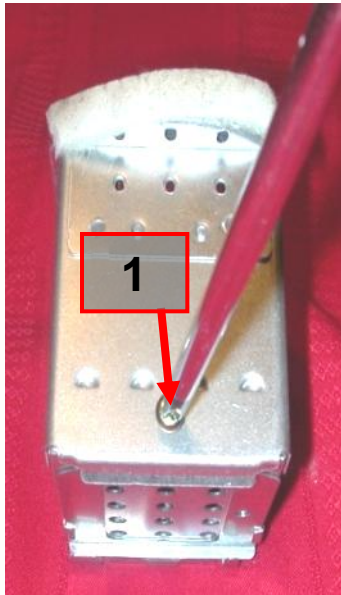


Burner Box Disassembly

Rinnai

Burner box can be disassembled for inspection (this is rare)

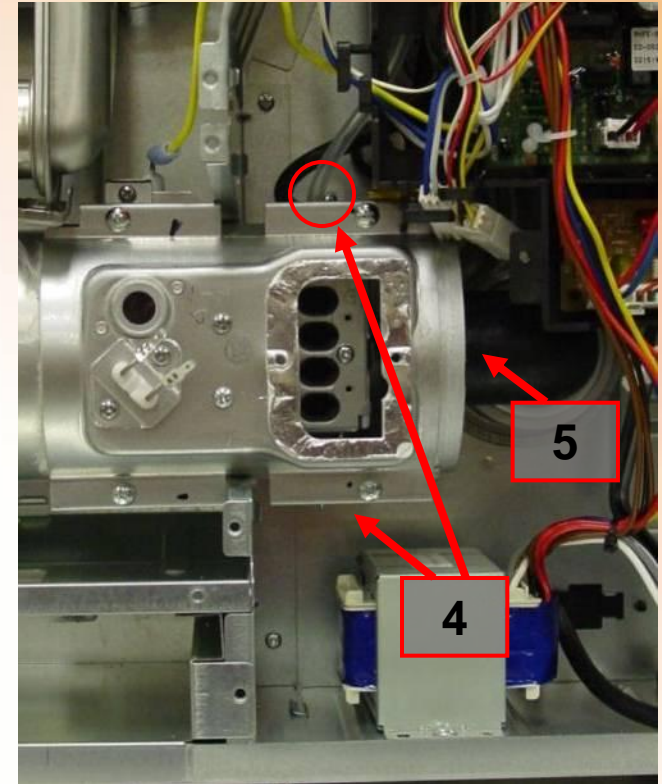
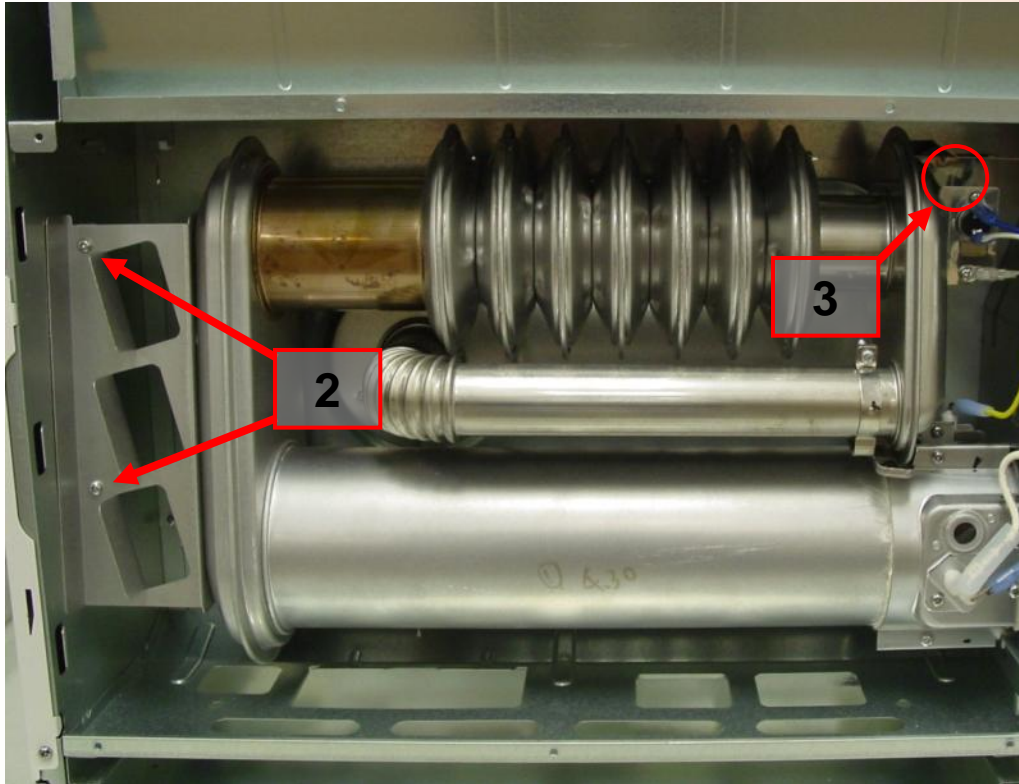
1. Remove single screw on back of burner
2. Remove plate on back of burner
3. Individual burners will come free.
4. NOTE: burner with flame capture plate must be installed in top of box. This ensures flame rod is capturing the flame correctly. 2009 and newer models do not have this plate.



Heat Exchanger Removal

Rinnai

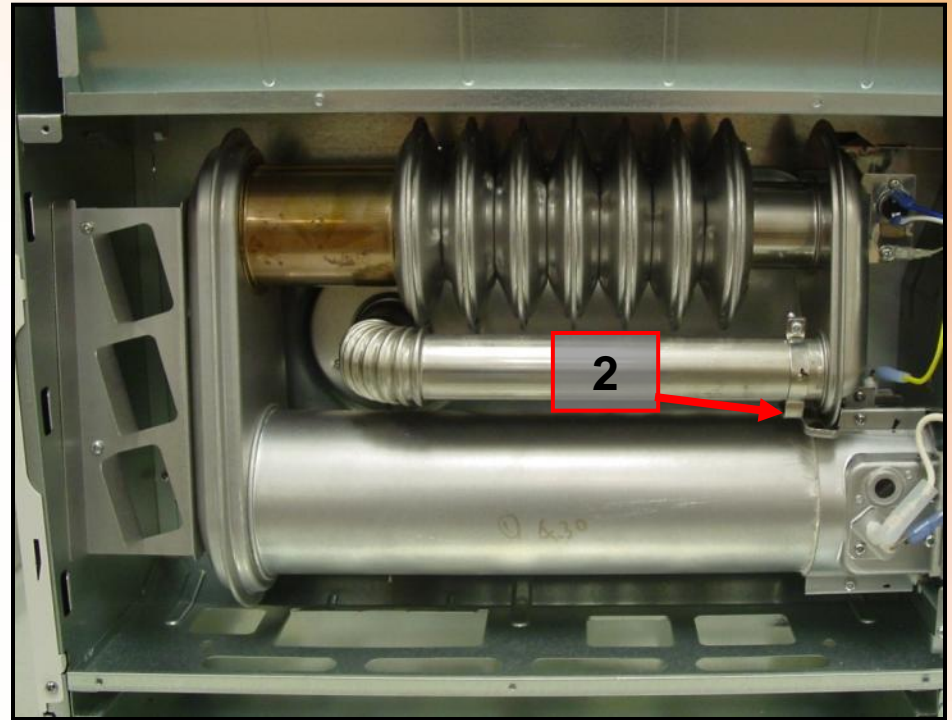
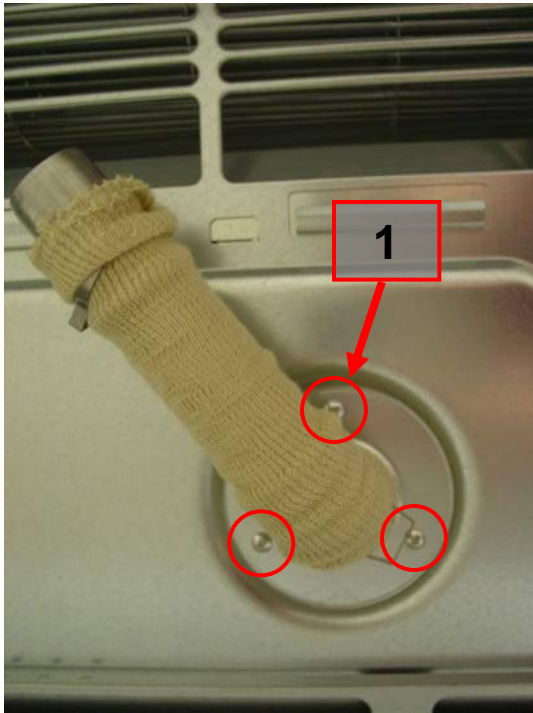
1. Remove front cover, inside panel, warm air seal panel, and burner box assembly, flame rod, and, if needed, convection fan assembly
2. Remove two screws on left of heat exchanger (2010 model screws are toward the front)
3. Remove single screw behind overheated bimetal and filter thermistor
4. Remove two screws behind right side of heat exchanger
5. Remove single screw attaching rubber boot to heat exchanger



Heat Exchanger Removal (continued)



1. Remove the three screws holding the exhaust elbow to the unit. NOTE: Ensure the O-ring inside the elbow is intact
2. NOTE: The mini-condensate tray on the top portion of the heat exchanger is to prevent condensation dripping on the burner box cover and gasket. This condensation can occasionally develop on the exterior of the heat exchanger.



The heat exchanger made of stainless steel and aluminized steel are formed to a bellows style to reduce expansion noise and to provide a larger surface area for efficiency

Verifying electrical values of individual components is not common but when necessary, must be conducted correctly and safely. Verifying incoming supply voltage is the most common metering need in the field—especially during installation.

Key points when troubleshooting electrical values:

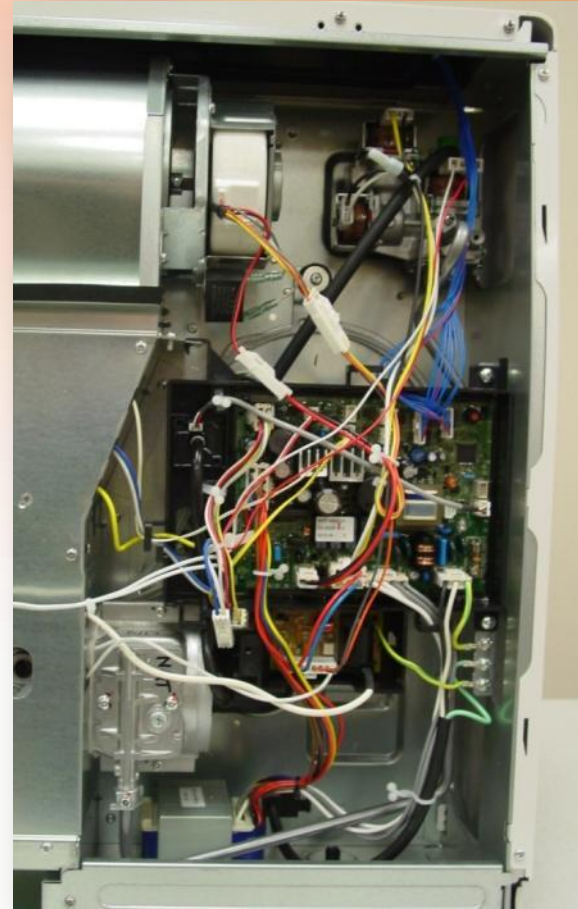
- Ensure volt meter probes are solidly contacting metal
- Apply probes to the back of Molex connections when possible to prevent possible damage to connection points
- Know your meter and how to set it for each type of measurement
 - Ω = Ohms or resistance
 - VAC or V_{\sim} = AC voltage
 - Always set meter to next highest value from range (as listed in manual)
 - $K = \times 1000$; ex. $6K\Omega = 6000$ Ohms
 - VDC or V_{-} = DC voltage
 - $\mu = \times .001$; ex. $6\mu A = 0.006$ Amps or 6 microamps
 - A=amps (ensure meter is set to DC current for flame rod measurements)
- When measuring resistance, ensure the component is disconnected from the circuit AND power is removed.
- When measuring a solenoid's resistance, place the meter probes on the solenoid's lugs (connection points) with the wires disconnected from.
- A correct resistance reading from a solenoid or transformer coil is not a guarantee that the component is good as the windings can open under load. An incorrect value is a very good indication that the component is bad though.

For metering values for models 2008 and earlier, reference Rinnai's Direct Vent Heater Service Manual

ENSURE YOU ARE READING THE CORRECT PAGE!

LAB EXERCISE

1. Measure incoming voltage
 - a) At receptacle or extension cord (108-132 VAC)
 - b) At primary of transformer: Gray-Gray = 108-132 VAC
2. Measure resistance of transformer secondary points
 - a) Gray-Gray = $5-20\Omega$
 - b) Red-Red = $0.5-2.0\Omega$
 - c) Brown-Brown = $1-5\Omega$
 - d) Black-Yellow = $150-350\Omega$
3. Measure continuity of safety circuit at various
 - a) At PCB connection point
 - b) If desired, at bimetals
4. Measure resistance of solenoids
 - a) POV: Red-White = $60-90\Omega$
 - b) SV1: Black-Yellow = $1.5-2.5K\Omega$
 - c) SV2: Black-White = $1.5-2.5K\Omega$
5. To measure flame rod current connect meter in series at flame rod Molex connector (yellow wire)
Current should measure greater than $1.0\mu A$ (DC current)



APPENDIX B

MODEL CHANGE QUICK REFERENCE GUIDE

Quick Reference Guide



| MODEL NUMBER CHANGES | | |
|----------------------|------------|------------|
| 2008 Model | 2009 Model | 2010 Model |
| RHFE-201RFA | ES08 | EX08C |
| RHFE-263RFA | ES11 | EX11C |
| RHFE-431RFA | ES17 | EX17C |
| RHFE-431RWTA | EX17 | |
| RHFE-556RFA | ES22 | EX22C |
| RHFE-556RWTA | EX22 | |
| RHFE-556RWTA-W | EX22W | EX22CW |
| RHFE-1004RFA | ES38 | ES38 |
| RHFE-1004RFA-W | ES38W | ES38W |











| AFUE CHANGES | | | |
|--------------|----------|----------|----------|
| Model # | Gas Type | Prv AFUE | New AFUE |
| EX08C | NG | 80.60% | 82% |
| | LP | 83.40% | 83% |
| EX11C | NG | 80% | 81% |
| | LP | 80% | 82% |
| EX17C | NG | 80% | 81% |
| | LP | 80.80% | 82% |
| EX22C / W | NG | 80.60% | 81% |
| | LP | 81% | 82% |
| ES38 / W | NG | 80.60% | 80.60% |
| | LP | 82% | 82% |

| Physical Specifications | | | | |
|-------------------------|------------------------------|---------|-------------------------------------------------------------|-------------------------|
| Model Number | Dimensions (W x H x D) | Weight* | Notes | |
| RHFE-201RFA | 16 3/4" x 26 5/8" x 9 7/8" | 39 | The EX08C and EX11C have the same dimensions and weight | |
| ES08 | | | | |
| EX08C | 18 1/4" x 27 3/8" x 10 1/8" | 46 | | |
| RHFE-263RFA | 16 3/4" x 26 5/8" x 9 7/8" | 37 | | |
| ES11 | | | | |
| EX11C | 18 1/4" x 27 3/8" x 10 1/8" | 46 | The EX17C and EX22C (W) have the same dimensions and weight | |
| RHFE-431RFA(WTA) | 29 1/2" x 21 13/16" x 9 7/8" | 51 | | |
| ES17, EX17 | | 53 | | |
| EX17C | 29 7/8" x 22 7/8" x 10 1/8" | 57 | | |
| RHFE-556RFA(WTA)† | 29 1/2" x 21 13/16" x 9 7/8" | 51 | | |
| ES22, EX22 | | 53 | | |
| EX22C | 29 7/8" x 22 7/8" x 10 1/8" | 57 | | |
| RHFE-1004RFA† | 36 5/8" x 26 3/8" x 13" | 90 | No Changes | * Product weight |
| ES38 | | | | † Includes white models |

Quick Reference Guide

Rinnai

ENERGYSAVER MODEL SPECIFICATIONS - PRODUCT COMPARISON

| Specifications | RHFE Models | R Series Models | C Series Models |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cabinet Design |  <p><i>ES08, ES11, ES17, EX17, ES22, EX22(W), ES38(W)</i></p> | |  <p><i>EX08C, EX11C, EX17C, and EX22C(W)</i> <i>ES38(W) does not change</i></p> |
| Control Panel | <p><i>ES08, ES11, ES17, ES22</i></p>  |  <p><i>EX08C, EX11C, EX17C, and EX22C</i></p> | |
| | <p><i>EX17, EX22(W)</i></p>  | <p><i>ES38 does not change - not C series</i></p>  | |
| Packaging - Label Changes |   <p><i>Cartons were color coded by model and gas type - label includes model number and serial number</i></p> | |   <p><i>Gas type and model numbers are now located on label - cartons no longer color coded</i></p> |

Quick Reference Guide



ENERGYSAVER MODEL SPECIFICATIONS - PRODUCT COMPARISON (continued)

| Specifications | RHFE Models | R Series Models | C Series Models |
|--------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------|--------------------------------------------------------------------------------|
| Warranty | 10 Yr HEX - Prorated | 10 Yr HEX - Prorated | 10 Yr HEX - NOT prorated (purchased on 4/1/10 or later - all models) |
| Dimensions | See chart | See chart | See chart |
| Weight | See chart | See chart | See chart |
| Restart Function (<i>power and gas outage</i>) | No | Yes | Yes |
| AFUE | See chart | See chart | See chart |
| Manual Shut-off | Integrated shutoff | 1/2" valve included | 1/2" valve included |
| Conversion Kit | In Box | In Box | As Accessory |
| Beeping Indicator for Restricted Filter | No | Yes | Yes |
| Standby Power < 1 Watt | No | No | Yes |
| Temperature Settings | F° and C° from PCB | F° and C° from PCB | F° and C° from Control Panel |
| Installation Template | Paper Template in Box - doesn't work with C series models | Paper Template in Box - doesn't work with C series models | On Outside of Box - doesn't work with previous models |
| Timers | Weekly - WTA Models Only | Weekly - WTA Models Only | Daily - C Series Models Only |
| High Altitude | 2000' | Up to 10,200' | Up to 10,200' |
| Setback Function | No | No | Yes (includes frost protection) |
| Display Dimmer | No | No | Yes |
| Combustion and Convection fan validation | Combustion Fan Only | Combustion Fan Only | Both - new code 62 for convection fan related issues |
| FOT-201 | N/A | N/A | New extension kit - replaces FOT-190 and includes intake hose |
| Maximum Temperature Setting | Special Order - or from PCB | From Control Panel | From Control Panel |

Quick Reference Guide



| ENERGYSAVER Major Technical Differences | | | |
|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------|-------------------------------------------------------------|
| Specifications | RHFE Models | R Series Models | C Series Models |
| Convection fan feedback signal (to ensure proper operation) | No | No | Yes |
| Pressure Sensor (to ensure proper operation) | No* | Yes | Yes |
| Long vent terminal and jumper (17/22 series only) | Yes* | No | No (No longer needed due to addition of pressure sensor) |
| Flame Rod Assembly (17/22 series only) | Screw accessible from top of assembly | | Screw accessible from front of assembly |
| Thermistor Calibration | No | No | Yes |
| Ability to insert a flag into the error code bank (FF code) | No | No | Yes |
| Plastic tray under control panel for accidental spills (to protect PCB, etc) | No | No | Yes |
| Gas valve pressure balancing tube (17/22 series only) | No* | Yes | Yes (To ensure pressure balance between vent and gas valve) |
| Gas valve-to-manifold interconnection tube | Connects to bottom of gas valve | | Connect to front of gas valve |
| PCB Differences (17/22 series only) | DIP switches and test buttons* | No DIP switches; Single test button for all settings | |
| Number of overheat bimetals (17/22 series only) | 3* | 3 | 2 (PCB bimetal eliminated due to redundancy) |
| Activation temp of overheat safety components (front bimetal(s) are unchanged; rear bimetals are on 17/22 series only) | Thermal fuse: 314° F Rear HEX bimetal: 266° F | | Thermal fuse: 421° F Rear HEX bimetal: 185° F |
| | The location of these components were altered creating the need to alter the activation temperature | | |
| *These changes were implemented on the 08/11 series several years ago | | | |

APPENDIX C

2000 - 2008 RETROFIT PROGRAM

What is this program about?



MODELS AFFECTED:

RHFE 431 FAIII
RHFE 431WTA
RHFE 556 FAIII
RHFE 556 WTA

There is a potential safety issue with two specific (previously manufactured) models of the Direct Vent Furnace products (Model RHFE 431 and RHFE 556 manufactured 2000-2007). Under certain rare circumstances a gasket used to seal between the burner cover plate assembly and the heat exchanger may not perform as intended, resulting in the potential for release of trace amounts of carbon monoxide into the space being heated by the product.

While there have been no reports of serious injury or death, as part of Rinnai's continuing effort to ensure a safe and efficient product for our customers, we are implementing a Voluntary Corrective Action Plan to locate and retrofit affected product with a different gasket and burner cover plate.

Because this issue presents a potential safety concern, Rinnai voluntarily reported the matter to the Consumer Product Safety Commission (CPSC). CPSC monitored the program's inception and rapid progress; and, has recently closed their portion of oversight. Rinnai will of course continue to be proactive in retrofitting as many products as possible at our expense.

Please contact Rinnai customer service (800-621-9419) for more information.

APPENDIX D

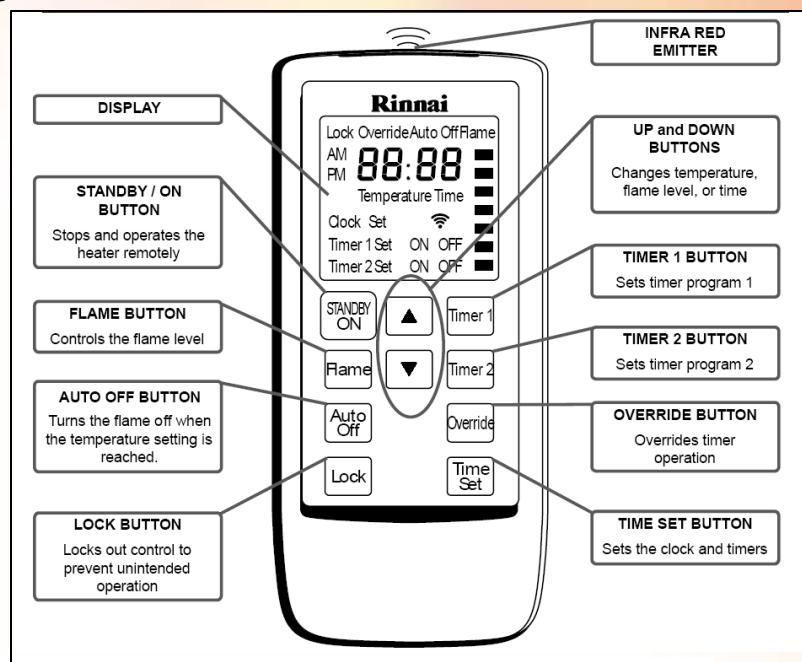
RHFE 750 ETRA DIRECT VENT FIREPLACE



Direct Vent Fireplace Features

Rinnai

- Now the modulating technology of Rinnai's Direct Vent Furnace is available as an attractive fireplace
- 3 Speed convection fan for even heat distribution
- Integrated zero clearance box
- Unique and versatile power flue technology with various venting options
 - Up to 33 feet of venting allowed
 - Vertical and horizontal terminations available
 - Ability to vent downward for terminations lower than fireplace (crawl space, lower floor, etc)
- Interchangeable fascia's—Plasma, Shine, Midnight, and Classic
- Push button electronic ignition
- Full feature remote control
- Thermostat control
- Pre-programmed flame function
- Set and forget dual timer
- Child lock
- Preheat and memory function
- Energy saving auto-off function
- Comprehensive safety features
- Double Glass front reduces heat on outer glass
- Approved for mobile home use



Direct Vent Fireplace Selectable Front Fascias

Rinnai



Flat Metal Black R2700



Flat Metal Stainless Steel R2701



Radius Silver R2702



Radius Black R2703

Product Model Numbers and Specifications



| Model Number | RHFE-750ETRA-N (Natural Gas) | RHFE-750ETRA-P (Propane Gas) |
|-----------------------------|-----------------------------------------------------------------|------------------------------|
| AFUE | 79% | Up to 83% |
| Gas rate input (Btu/hr) | Low-11,000 | Low-11,000 |
| | High-29,000 | High-28,000 |
| Gas rate output (Btu/hr) | Low-8,635 | Low-8,855 |
| | High-21,900 | High-21,840 |
| Minimum gas supply pressure | 4.3" (109 mm) W.C. | 9.8" W.C. (249 mm) |
| Maximum gas supply pressure | 10.5" (267 mm) W.C. | 13" (330 mm) W.C. |
| Electrical connection | 120 VAC, 60 Hz | |
| Gas connection | Flex line: 3/8" flare nut; ball valve; 1/2" female X 3/8" flare | |
| Ignition system | Electronic spark ignition | |
| Exhaust system | Forced combustion, forced convection | |
| Temperature settings | 60° -80° F in 2° increments (16° -26° C in 1° increments) | |
| Temperature control | Electronic thermistor | |
| Warm air outlet | Bottom front louvers | |
| Weight | 150 lbs | |
| Warranty | All parts: 2 years from date of purchase | |

RINNAI DIRECT VENT TECHNOLOGY

PLEASE CONTACT TECHNICAL
SUPPORT FOR ANY QUESTIONS OR
ISSUES